SAN FRANCISCO PUBLIC LIBRARY
3 1223 06436 3733

COMPOSTING IN SCHOOLS

A "HOW TO" GUIDE

= City Administrator

San Francisco
RECYCLING
PROGRAM

DOCUMENTS DEPT.
MAR 10 1999
SAN FRANCISCO
PUBLIC LIBRARY

D

REF
631.875
C7375

COMPOSTING IN SCHOOLS
A "How To" Guide

Mayor **Willie L. Brown, Jr.**
Director **Paul V. Horcher**

San Francisco
RECYCLING
PROGRAM

Organics Recycling Coordinator **Jack Macy**

Staff Contributors **Amy Ma**, Organics Recycling Associate,
Heidi Melander, Organics Recycling Associate and
Michèle H. Gelow, Technical Writing Intern

San Francisco Solid Waste Management Program
1445 Market Street, Suite 401
San Francisco, CA 94103
Phone: (415) 554-3400
Fax: (415) 554-3434
Recycling Hotline: (415) 554-7329
Home Page: www.sfrecycle.org
E-mail: sfrecycle@ci.sf.ca.us

The following organizations have allowed the reprint of resources and technical information:
- Alameda County Waste Management Authority
- San Francisco League of Urban Gardeners (SLUG)
- New Hampshire Department of Environmental Services

Worm Illustrations: **Joal Morris**. Wiggle E. Worm © 1993, Ecology Action of Santa Cruz

Printed on 50% post consumer recycled paper

Listings of firms or products do not constitute endorsement by the Solid Waste Management Program.

This guide was published in November 1997, revised August 1998. The materials were created to be copied and used, subject only to acknowledgment of the San Francisco Solid Waste Management Program.

TABLE OF CONTENTS

Introduction 1
  Purpose of the Guide
  What is Composting?
  Why Compost in Schools?

Basic Composting Systems 4
  What Is It?
  The Ingredients
  Basic Bin Feeding and Maintenance
  Hot Composting and Cold Composting
  Is it Done?
  How to Harvest
  Types of Basic Bins

....9

Bin

....13

....15

....16

Compost
or You
Feeding and Maintenance Duties

....23

Appendices

Appendix A ....Case Studies

Appendix B ....Literature and Resources

Appendix C ....Troubleshooting

Appendix D........Charts and Signs

Appendix E ....Blueprints and Resources

Appendix F........Curriculum and Activities

5/S

San Francisco Public Library

Government Information Center
San Francisco Public Library
100 Larkin Street, 5th Floor
San Francisco, CA 94102

REFERENCE BOOK

Not to be taken from the Library

TABLE OF CONTENTS

Introduction 1
- Purpose of the Guide
- What is Composting?
- Why Compost in Schools?

Basic Composting Systems 4
- What Is It?
- The Ingredients
- Basic Bin Feeding and Maintenance
- Hot Composting and Cold Composting
- Is it Done?
- How to Harvest
- Types of Basic Bins

Worm Composting 9
- What Is It?
- Red Wiggler Worms
- How Many Worms Will You Need?
- Types of Worm Bins
- How Much Space?
- Preparing and Maintaning Your Worm Bin
- Harvesting Your Worm Bin

Using Compost 13
- What Compost Can Do For You

Summer Maintenance 15
- Basic Bins and Worm Bins

Starting Your Program 16
- Step 1 - Get Everyone's Support
- Step 2 - Determine What You Have to Compost
- Step 3 - Determine Which System is for You
- Step 4 - Get Coordinated: Collection, Feeding and Maintenance Duties
- Step 5 - Spread the Word

Glossary 23

Appendices

Appendix A ....Case Studies

Appendix B ....Literature and Resources

Appendix C ....Troubleshooting

Appendix D........Charts and Signs

Appendix E ....Blueprints and Resources

Appendix F.........Curriculum and Activities

Digitized by the Internet Archive
in 2014

https://archive.org/details/compostinginscho1998sanf

1. INTRODUCTION

Purpose of the Guide

This guide is for educators and students who want to start a composting program in their school. It will help you to start your own program by:

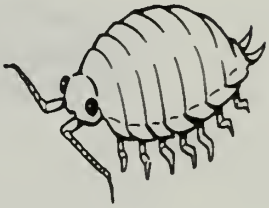
- Describing "basic" and "worm" methods of composting.
- Outlining the steps needed to begin your program.
- Suggesting ways to get and keep students motivated.

The Appendices give examples of composting systems and programs from other schools in the City—they also provide tips, troubleshooting, blueprints for building your own bins as well as ways to incorporate composting into your curriculum and a list of suggested books.

What is Composting?

Composting is the natural breakdown process of organic materials (food, plant and wood waste) through microorganisms (bacteria, fungi) and invertebrates (worms, insects, sowbugs) which results in a nutrient-rich soil amendment commonly known as compost. Mother Nature has been composting since life first appeared on this planet. For example, leaves fall to the forest floor and decompose thereby giving their nutrients back to the trees that first gave them life. Nature is the greatest recycler ever, constantly breaking down millions of tons of organic materials every day.

Even though decomposition—and therefore compost—happens naturally, as with many processes of nature, we can lend a helping hand. By building and maintaining proper balances of materials, air and water in a composting system, we can control the process and create more compost in a shorter period of time than Mother Nature might. In the end you have a rich, dark earthy humus, that's full of nutrients and can be used as a fertilizer for your plants.



Though there are several ways to compost, this guide discusses the "basic" and "worm" methods. Either approach works depending on what types of wastes are being composted and which method is best for you.

Why Compost in Schools?

Did you know that up to a third[1] of the garbage generated by the average school is made up of cafeteria food scraps, leaves and yard waste? This waste is taken to a landfill, which creates an added expense for schools, wastes a valuable resource and further contributes to the problem of our landfills becoming too full. By starting a composting program in your school, you:

1. Save energy, money and landfill space.

Hauling away the waste incurs transportation and disposal costs for schools. It also results in wasted energy, air pollution and uses up valuable landfill space. By composting, you don't need to hire someone to come and take away your waste. You also don't have to store the waste until it is picked up.

2. Teach students about the environment.

Composting can teach students about biodegradability, soil science, resource conservation, recycling and life-cycles. If they know more about how composting can help our planet, students will be more likely to participate. Chances are they don't know that composting can help reduce erosion and your garden's fertilizing and watering needs.

3. Integrate the program into many areas of study.

Composting involves many elements of learning, and the fact that it is a hands-on experience can really get students to "dig in."
This program can involve:

- environmental issues
- math
- science
- English

You can even go back to the beginnings of composting to teach about history, geography and social studies.

---

[1] According to a 1992 study conducted by the City of Los Angeles, Board of Public Works Integrated Solid Waste Management Office for the Los Angeles Unified School District. Actual percentage will vary considerably depending on the school's location.

3 1223 06436 3733

4. Get students outside.

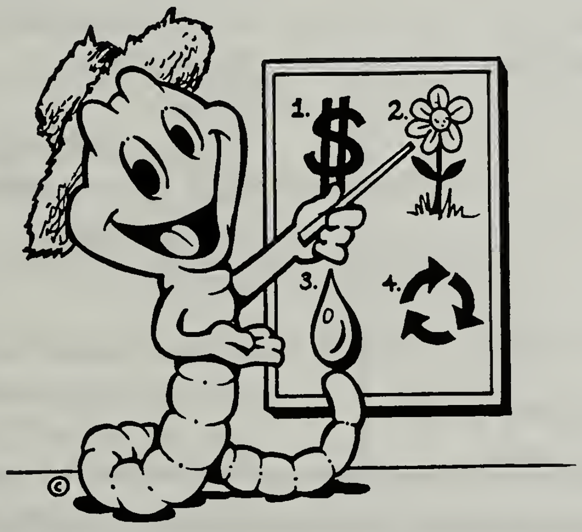
By creating a composting program, you have an excuse to get students out into the fresh air. Composting, larger than classroom scale, is ideally maintained outdoors, involves some physical activity and is fun! The students are also encouraged to work together and learn how to manage a project—all valuable to their future and well-being.

5. Use your compost.

Composting allows you to produce a valuable end-product that you can either use at the school as a soil amendment, give to students for use in home gardens or sell for fund-raising. Compost improves soil structure (water retention and aeration), fertility and soil health. The students will feel good about helping the environment and having something that they can see and feel that shows them "I did this!" It's a great way to build self-worth and esteem.

6. Encourage students to compost at home.

In addition to students participating in composting programs at school, encourage them to apply the same concepts in their homes. The City and County of San Francisco is required to reduce by 50% the amount of waste sent to the landfill. If students help their families begin composting at home they, too, can help us reach that goal.



2. BASIC COMPOSTING

What Is It?

Basic composting is a method which breaks down garden and landscape trimmings into compost often in combination with food and vegetable scraps from a kitchen or cafeteria. This system can be managed in open layered piles but in order to keep things neat in the school yard, we recommend using the various rodent resistant bins. See page 8 for some descriptions of basic bin types. These bins are kept outside.

The Ingredients

Food: Browns and Greens

Food and other organic materials can be classified as either "brown" or "green" (see table below). In order for the materials to decompose rapidly, they need to be combined properly. Brown materials, or browns, are the carbon-rich materials that provide the energy microorganisms need to break down organics. The green materials, or greens, are nitrogen-rich and help the microorganisms build protein. Ideally, for a good nutrient balance use the following ratio:

two-thirds browns + one-third greens = happy, productive microorganisms

Refer to this table whenever you're not sure:

Do's	**Don'ts ***
Greens • Fruits & Vegetables • Coffee grounds and filters • Tea bags • Grass clippings **Browns** • Dry leaves • Straw • Newspapers • Woodchips • Sawdust (from untreated wood) • Chopped, woody prunings	• Meat, bones, fat, grease • Oils, salad dressings • Dairy products • Liquids • Plastic forks & bags • Dog, cat or bird feces • Diseased plants • Bread *Some organic materials do not degrade easily and might attract rodents or cause odors. DO NOT USE THEM.

The ingredients in this recipe will ensure that decomposition is done properly and efficiently. You can further help by chopping food into smaller pieces, which increases the surface area for the microorganisms to work and will help to speed decomposition.

Note: The 2:1 ratio, by volume, can be varied depending on how well the materials are mixed and if you maintain an optimum balance of air and moisture.

Air and Water

As mentioned before, the composting organisms need both air (aerobic conditions) and water in the proper balance to be most effective; composting is an aerobic process. Bacteria, fungi and other microorganisms need water to function, however, too much will suffocate them. If your compost becomes too wet or compacted, anaerobic bacteria—which thrive when there is a lack of oxygen—can take over and make your pile smell like rotten eggs.

Maintaining the balance between air and water is pretty easy. If your pile becomes too dry, add water. If it is too wet, you can either turn the pile more frequently to aerate it and/or add more browns to absorb extra moisture. Keep this in mind:

> Your pile should always be "as moist as a wrung out sponge."

If you hand-squeeze and	It's	Do
a drop comes out	fine	nothing
nothing comes out	too dry	add water
more than a few drops come out	too wet	add browns

Basic Bin Feeding and Maintenance

Equipment

You'll need:

- a basic bin (see examples on page 8 and appendices)
- a knife or clippers to chop materials
- a digging fork or shovel

To start composting follow these steps:

1. Use small pieces.

- Chop or shred as much of the food materials as possible.
- Bury and mix food materials into the compost

—or—

- Spread food and green materials thinly and cover with at least 2" of brown materials.

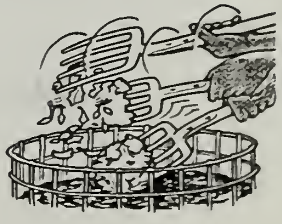
2. Use 2:1 ratio.

- For the most ideal conditions, add and mix materials in the bin using an approximate 2:1 ratio of browns to greens.

—or—

- Layer the browns and greens, using the same ratio.

Adding a little bit of soil or compost will speed up the process.



3. Maintaining air and moisture.

- Keep your compost "**as moist as a wrung out sponge.**"
- Turn occasionally.
- Test by squeezing a handful (see chart on previous page);

Your pile can also become too compacted. Turn the pile to "fluff" the materials.

Problems? See the Troubleshooting section in Appendix C.

Hot Composting

The ideal temperature for rapid composting is 120–140°F. This is referred to as "hot" composting. Keeping your compost between these temperatures will speed up the process (you can have finished compost in 2–3 months). Temperatures at 131°F should kill any weed seeds and pathogens present, although this is not necessary it is encouraged when composting food scraps. Temperatures much above 140°F can kill the microorganisms needed for decomposition. For your pile to generate enough heat on its own, we recommend that it be at least 3' x 3' x 3' or in an insulated box. The larger the pile, the easier it will be to get and maintain high temperatures for your compost. The size of your pile will depend on how much space you have and the amount of material you feed it.

In order to maintain the proper oxygen supply of your pile, which will help keep the pile hot, you should turn or mix it at least once a week.(The heat is generated from the energy released from the microorganisms during decomposition.)

To check the temperature of your compost, use a long-stemmed compost thermometer—or, tie a cord to a regular thermometer so you can easily retrieve it from the pile. Be sure to wash it afterward. When checking the temperature, check from the center of your pile, since this is where the bulk of your compost is.

Cold Composting

Cooler temperatures will also compost, but the process will take a little longer and weed seeds won't be killed. "Cold" composting works well if you don't have a lot of time to devote to maintaining your pile.

Problems? See Appendix C for troubleshooting.

Is it Done?

You'll know when your compost is ready to be harvested when it is a rich, dark soil-like brown and has a clean, sweet, earthy smell. If you can still recognize pieces of undecomposed materials and a stronger odor, it's not ready yet—let it sit a little bit more. Your finished pile should be warm, not hot, to the touch. Compost that is still "cooking" will be too hot to use on plants. Composting usually takes at least 3–6 months. It will take longer if you don't turn it every week.

Here's a test: put moist compost in a sealed plastic bag and let it sit in the sun for a day. Then open the bag and smell. If the odor is strong, more composting time is needed.

How to Harvest

When you've determined that your compost is ready to be harvested, follow these steps:

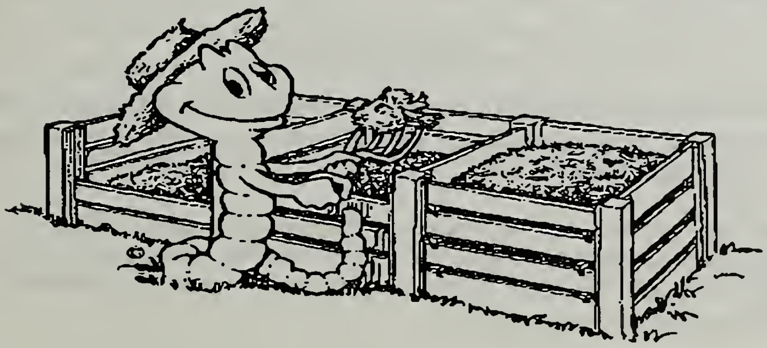
Bins with a harvest door

Compost will fall to the bottom.

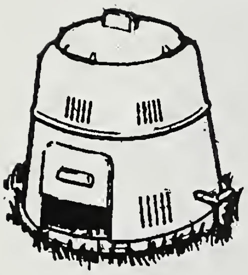
- Open the door and remove the compost from the bottom of the bin.
- Add fresh materials to the top.

Bins Without a Harvest Door

- Stop adding material to the bin at least a few weeks before harvesting and turn once a week.
- Take all the material out of the bin and put it on the ground for now. Put the bigger pieces of materials (the ones that haven't fully decomposed yet) back into the bin. The finished compost, which is finer, will fall to the bottom of the bin.
- Remove the compost and use it in the garden or store it for future use.
- Keep composting the remaining material.



Types of Basic Bins (Examples)

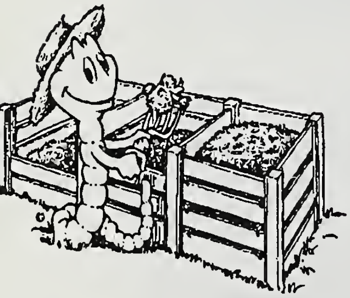


Earth Machine

- A manufactured bin of recycled plastic
- Designed for "hot" or "cold" composting.
- Has a side harvest door.
- Turning compost can be difficult.
- Dimensions: 34" tall, 38" in diameter at base.
- Capacity: 11 cubic feet.
- Cost*: $90 (may be available from SLUG at discount; 415-285-7585.)

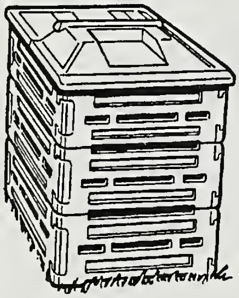
Urban All Wood Bin

- Handmade wood and wire bin
- Designed for "hot" or "cold" composting.
- Has a side harvest door.
- Turning compost can be difficult.
- Dimensions: 35" x 35" at base
- Capacity: 11 cubic feet.
- Cost*: $100–120 for new materials; see Appendix E for blueprints.



Three Bin System

- Hand-made wood and wire bins.
- Designed for large-volume, "hot" composting and active turning.
- Materials are turned from one compartment to another.
- Requires at least 3'x 9' of space.
- Dimensions: 108" x 36" x 31.5"
- Capacity: 3 cubic yards.
- Cost*: $175–200 for new materials; see Appendix E



Biostack

- A manufactured, plastic stacking bin
- Designed for "hot" or "cold" composting and active turning.
- Requires 3' x 6' of space for turning.
- Dimensions: 28" x 28" x 30"
- Capacity: 13 cubic feet.
- Cost*: $99.

*prices subject to change.

These bins all have lids and are considered rodent resistant. Whenever you compost fruit and vegetable trimmings, the Health Department requires a rodent-resistant system. Use a container with a lid, a floor, and no holes bigger than 1/4 inch.

If you need help purchasing bins, contact the San Francisco Recycling Program (SFRP) at (415) 554-3400. They may be able to supply you with the bins or provide information so you can purchase the bins or materials yourself. You may also ask about more expensive, high-tech systems which can handle 100 pounds or more a day.

3. WORM COMPOSTING

What Is It?

Worm composting is a system that uses red worms to break down fruit and vegetable scraps only (e.g., apple cores, melon rinds, etc..) Do **not** use yard waste for worm composting (except for soft leaves or grass). The red worms "recycle" kitchen scraps by eating them and producing castings (or worm poop) which is a high-quality fertilizer that can then be used in a garden or on houseplants. The process takes about 2-3 months.

Red Wiggler Worms

When stocking a worm composting system you can't just go out and dig for worms (unless you know where to find them). You need to use a certain species of worm for your bins. The best worms to use are the red wigglers (Eisenia foetida or Lumbricus rebellus). These worms will live near the surface of a pile and are about 3 inches in length.

You can purchase red wigglers from a nursery or mail order company (see Appendix E for resources) or get them from an existing worm bin. Worms cost $10–20 a pound. They reproduce easily, however, so if you add new bins, you can just take worms from a bin that you or someone else already has.

Note: If you have a small budget and can only purchase a few pounds of worms, start with a smaller bin and add bins as the worm population grows.

Don't use earthworms, such as nightcrawlers, because they burrow much deeper into soil and can grow up to 12 inches in length.

How Many Worms Will You Need?

To determine how many pounds of worms you need, you will have to figure how much fruit and vegetable scraps you can collect each day. Worms will eat about half their body weight a day; so we recommend that you use a worm to food scraps ratio of 2 pounds of worms to 1 pound of food. For example, if you want to compost 10 pounds of food each day, you need 20 pounds of worms. In other words:

pounds of waste per day x 2 = pounds of worms needed

Types of Worm Bins

For worm composting, you need a home for your worms - a worm bin. Worms bins are to contain the process and worms and keep rodents out. Worm bins can be large or small depending on how much space you have and how much food you want to feed it. For a small system, a shallow box with a lid will be just fine. Remember that worms like to live under layers of moist leaves or shredded paper, so you will have to supply your worms with these to keep them happy and productive. The layers help to keep your worms cool and moist, supply them with fiber to eat and will prevent fruit flies from being attracted to the food scraps that you are composting.

You have many options with starting a worm composting program at your school. You can have a small, single-classroom bin, a 2-3 classroom bin or larger bins that will compost all the food scraps from the cafeteria. The size of your bin will depend on how many teachers are willing and/or able to help with the program. However, if your school has limited teachers available to help with the program, fewer bins would be better.

To determine which bin will work best for you, see the following bin specifications; blueprints and retailers are available in Appendix E.

How Much Space?

You should have 2 square feet for each pound of worms at least to start with. Use the table below to figure out (1) the amount of worms to purchase, (2) the space needed and (3) the number of the bins.

pounds of food per day	**pounds of food per week**	**pounds of worms you'll need**	**square feet of worm bin space needed**	**number of 2' x 4' bins you'll need (8 sq. ft. each)**
1	5	2	4	1
2	10	4	8	1
3	15	6	12	2
4	20	8	16	2
6	30	12	24	3

Remember, you can use a basic bin for the scraps that don't fit into your worm bin.

Call the SFRP at (415) 554-3400 for grant information; we may be able to give you money to support your program or provide you with bins. Try also soliciting donations of supplies from lumber and paint companies.

Preparing and Maintaining Your Worm Bin

Equipment needed: worm bin, worms, chopped materials, shredded newspaper, water

1. Make a Worm Bed.

- Fill the bin with thin strips of black and white newspaper and fluff.

  Do **not** use glossy or colored newspaper because they may have toxic inks.
- Moisten the bedding by spraying with water until it is **"as moist as a wrung out sponge."**
- Add a few handfuls of garden soil and/or crushed eggshells and mix into the bedding. This will help the worms' gizzards function correctly.

2. Add Worms

- Place worms under the bedding.

3. Feed the Worms

- See Dos and Don'ts below.

  Remember to always bury the food under the bedding to prevent fly problems.
- Wear gloves.
- Before adding food, cut large pieces with scissors or a shovel.
- Rotate the feeding area to help spread scraps evenly throughout the bin.

Do's	**Don'ts**
Greens (food)	Meat, bones, fat, grease
Fruits & Vegetables	Oils, salad dressings
Coffee grounds (filters are ok)	Dairy products
Tea bags	Liquids
	Plastic forks & bags
Browns (as bedding only)	Dog, cat or bird feces
Shredded newspaper	Diseased plants
Leaves (only small amounts)	Bread
Straw	

4. Keep Bedding Fresh

- Add fresh bedding every 2–4 weeks.
- Keep a 4"- 10" layer of bedding over the worms. This will keep your worms from drying out.
- Keep bedding and composting material **"as moist as a wrung out sponge."**

Harvesting Your Worm Bin

When the contents of your bin (or bins) are dark and fairly uniform and mostly castings, it is time to harvest your compost. There are two ways that you can harvest your bins:

Move Over Method

1. Move the contents of the worm bin to one side.
2. Add fresh bedding to the second side.
3. Bury food on the bedding side **only**. After several weeks the worms will have moved over to this side, since that's where the food will be.
4. Harvest the compost from the first side once they've all moved over.
5. Add fresh bedding and food.

Voilà! Your first batch of compost.

"Dump It" Method

1. Dump the contents of the bin onto a large sheet of plastic either in the sun or under a bright light.
2. Make several smaller piles. The worms will crawl away from the light to the middle of the piles.
3. Collect castings from the outsides of the piles.
4. Put the worms back in the bin.
5. Add fresh bedding and food.

Note: If you're interested in an excellent book on worm composting, read Mary Appelhof's book *Worms Eat My Garbage.*

4. USING COMPOST

What Compost Can Do For You

Some things that compost can do for you are:

- Improve the structure of your soil and help it retain more water and nutrients.
- Add minerals to your soil.
- Inoculate your soil with beneficial soil organisms that will help your plants grow big and healthy.

Finished compost is an excellent soil amendment that you can use in many ways. Generally, worm compost is a stronger nutrient source than basic compost, but both are very good for your garden and plants. Below are a few suggestions on how to use your compost. Good luck and happy gardening!

As an Amendment

Before planting,

- Layer 4"- 8" of compost into newly reclaimed or poor soils.
- Layer ½"- 1" of compost on annual garden beds at least once a year.
  You can also sprinkle a layer of compost on potted plants or mix some into the soil before planting (see below).

Note: Keep in mind that even if you don't have an outdoor garden you can still use your compost; compost works just as well on indoor plants.

As a Mulch and Top Dressing

Mulches keep the wind and sun from drying out your soil; they can also help to prevent erosion by wind and/or water. Mulches, like compost, add nutrients to the soil and they also keep thirsty weeds from taking over your garden.

To use _basic_ compost as a mulch:

- Spread a 1"- 4" layer around all plantings.
  The mulch will suppress weeds and conserve water.

To use _worm_ compost as a top dressing:

- Spread a ½"–1" layer on potted plants, in the garden and/or in your yard.
  Worm compost provides nutrients for your plants, but doesn't make a very good weed suppresser.

In Potting Mixes

- Mix equal parts basic compost and garden soil (or horticultural sand) for your own blend of potting mix

  –or–

- Mix one part worm compost with three parts commercial potting mix.

Make Compost Tea

- Fill a bucket one-quarter full with compost.
- Top it off with water.
- Let the mixture sit for a few days to "steep."

When the water has turned brown:

- Water your plants once a month with your compost tea

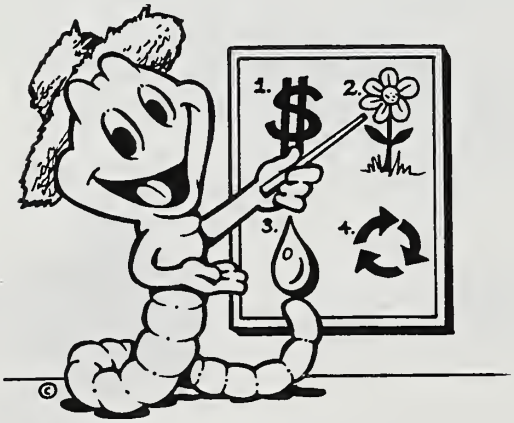
  –or–

- Dilute it and spray the tea on the leaves of your plants. This acts as a foliar feed.

Sell It!

- Sell your compost as a soil amendment to raise funds for your school.

Sell it to parents, friends, out in the community, anyone who has a garden; you may even find a local gardener who will be thrilled to use or market your school's compost.



5. SUMMER MAINTENANCE

Basic Bins

For the most part, you can leave your basic bins alone over the summer. However, they will continue to work if they are watered every two weeks or so. Wooden bins (as opposed to plastic bins) dry out very easily in summer heat, so it's best to keep them moist and keep an eye on them. If your bins dry out, jump-start them by adding the necessary ratio of materials in the fall.

Worm Bins

Worm bins need some attention over the summer. Because of the worms, they are a bit more high-maintenance than basic bins. In order for your worm bins to continue to flourish over summer vacation, you will need to recruit some help and organize staff, parents and students or community volunteers to maintain your bins. Unless your worms are fed regularly, they will die. Some schools have been innovative and have managed to get parent volunteers to bring in their kitchen waste over the summer. Others have even been able to secure large amounts of food waste to be donated from local grocery stores; that way you know your worms won't go hungry. If the bins are small and portable, they can be taken home by students, staff or teachers. Another option is to lend worms to responsible students to feed in a bin at home. Give one-half pound to one pound of worms to each student in a small homemade box or shoebox with plastic lining. Remind them not to overfeed and to keep moisture levels adequate. They should bring them back at the start of school.

6. STARTING YOUR PROGRAM

Step 1 – Get Everyone's Support

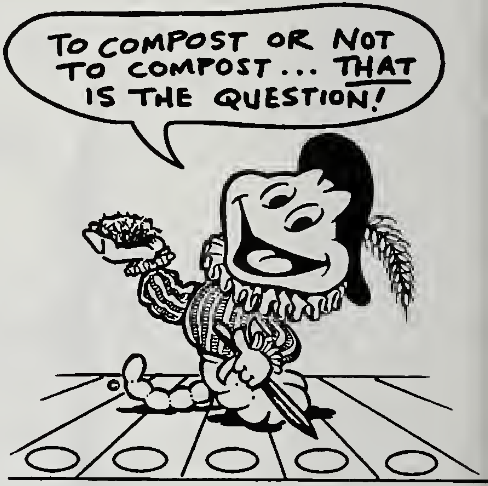
This is probably the most crucial step to implementing a composting program in your school. You will need to:

- Choose a leader to coordinate the program.
- Get your principal's approval to run the program.
- Get support from administration, other teachers and maintenance staff.

Everyone in the school will be affected by the program one way or another, so you need to make sure that everyone will be supportive of the project.

When a leader has been chosen, he/she should:

- Review this guide.
- Explain the program to everyone.
- Tell others what will be expected of them.
- Rally assistance and sign a pact of commitment.
- Determine what system would work best for the school.
- Answer questions.


TO COMPOST OR NOT TO COMPOST... THAT IS THE QUESTION!

Get as much support as you can—don't forget to ask PTA members to help; some may be expert gardeners happy to help.

Tips

Sell your composting program on the positive aspects. Some pluses:

- Composting involves science and ecology and can therefore be integrated into the curriculum for these subjects as well as others.
- Students will need to work with the community which teaches leadership and group skills and can develop project management skills.
- By composting you may be able to save the school some money; you will be able to cut down the amount of waste that needs to be hauled away and you can buy less fertilizer.

Be sure that everyone understands **how** composting works and **what** a school composting program involves; it will require some time and commitment from everyone involved.

Step 2 – Determine What You Have to Compost

You need to:

1. Refer to the tables on pages ~~5~~ 4 and ~~13~~ 11 to see what you can compost.
2. Target the materials for collection.
3. Conduct a waste audit.

Conducting a Food Waste Audit

- This is to determine how much waste you generate which will tell you how many bins you will need. To conduct your audit:
    1. Create an audit team.
    2. Decide what food waste to collect.
    3. Assign a few people to be monitors (maybe a student and a teacher).
    4. Set several buckets around the kitchen and lunch areas, preferably near the garbage cans.
    5. Label the buckets with "yes" and "no" signs from Appendix D or make your own. Labels will remind people what can and can't be collected.
    6. Encourage students, cafeteria staff and teachers to separate their fruit and vegetable wastes from their other food wastes.
    7. Weigh the buckets at the end of every lunch period for 1–2 weeks.
    8. Calculate and log the average daily weight for compostable materials. *For basic bin use, include an estimate for garden trimmings you will compost.*

Step 3 – Determine Which System is for You

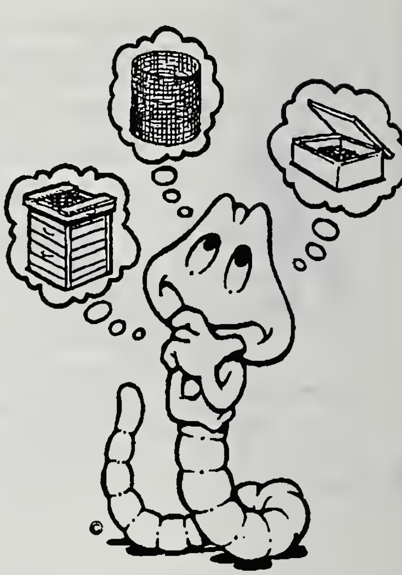
To make sure that you choose the correct system for your school, consider these things:

- Audit results - identify the material quantity and type to be composted.
- Composting systems - decide which one is most appropriate.
- Space - enough room for the bins you need.
- Resources - Does your school have the resources to buy or build bins?
- What do other schools do? (talk to other schools and/or see Appendix A)

Location, Location, Location... Basic bins can either be in the sun or in the shade; but, if you put them in the sun the composting material may dry out more easily, so be sure to check the moisture levels often. Worm bins, however, must be in the shade to keep them from overheating. Some requirements are:

- Have enough space for the bins and for maneuvering around them.
- Have a level surface.
- Have easy access from the collection area.
- Be inaccessible to the general public.
- Have a readily available water source (or watering can).
- Be close to the final destination of the compost (e.g., gardens).

The location of your system can be a determining factor in which system you choose, so check-out your location very carefully.



Choosing Your System

When you know where to put your composting bins, decide which system you want to use. It is possible that you might not have enough space to compost *all* the food waste or yard waste you generate. Choose a system which will be sustainable within the limitations of your school.

In a densely populated city like San Francisco, it is extremely important that your composting system meets these minimal requirements:

- rodent-proof.
- have a floor or be set into the ground
- have a secure lid
- does not have holes in the bins any larger than ¼" in diameter.

If you want to look at the different bins, you can visit the San Francisco League of Urban Gardeners' (SLUG) Garden for the Environment; call their rotline at (415) 285-7585 for more information and garden hours. Another place to get some information is St. Mary's Urban Youth Farm Compost Education Centers (on Alemany Boulevard near Ellsworth).

Step 4 – Get Coordinated

In order for your composting program to run correctly, you need to coordinate organics collection, bin feeding and maintenance. These steps should help:

- Determine the most convenient place(s) for the collection buckets.
- Select a team of volunteers.
- Set clear instructions for duties.
- Assign duties for collection, feeding and maintenance crews.
- Ask kitchen staff (if any) to help by collecting their fruit and vegetable scraps.
- Be sure you have adequate volunteer staff helping with the program.
- Fill out the volunteer chart.

When selecting your volunteers, be sure that they are reliable. They must also be willing and eager—you need enthusiasm to keep your project going. Try getting a few classes involved; that way you can distribute the duties better and no one will be overburdened. Teachers can set up rotating schedules for collection and maintenance helping to distribute the duties and give everyone a chance to participate. Also getting kitchen and cafeteria staff involved will help.

Collection, Feeding and Maintenance Duties

Here are some examples of collection crew duties. You'll probably come up with more depending on your school:

- Set-out food collection buckets wherever people are eating.
- Label the buckets with "yes" and "no" signs so people remember what can and can't be composted.
  Monitors should encourage teachers and students to use the buckets.
- Collect and weigh buckets when most people are done eating.
- Track and log the weights in a log book.
- Take buckets to the compost bins.
- Distribute scraps into bins.
- Cover food with brown material or bury into existing compost if you're using basic bins.
- Place waste under shredded newspaper bedding if you're using a worm bin.
- Keep moisture level **"as moist as a wrung out sponge"** by adding water when composting materials are too dry, or adding dry material when the materials are too wet.

If the collected scraps are highly contaminated with items such as plastic or meat:, sort out contaminants or throw away the contents.. *Always wear gloves when handling scraps.*

Remember, these are just some suggestions; you will have to tailor them to your program.

Note: See sample volunteer chart in Appendix D.

Step 5 - Spread the Word

Now that you know that your school is capable of running a composting program, tell everyone and create enthusiasm:

- Tell students and administrators how the program will run.
- Kick-off the program.
- Create on-going promotion.

The more people in your school who understand the program, the more interested they will be and therefore the more involved they will become.

Kicking it Off

Make a big deal about your composting program; set aside some time to have a school-wide celebration to really get people excited. One school had a "Worm Day" to start its program with a puppet show, introductions to the worms and a composting song. Here are some other ideas for kick-off events:

- invite keynote speakers to endorse your composting program.
  SLUG and the SFRP can provide free workshops and teacher training; someone from these organizations would make an excellent speaker for your kick-off celebration.
- kick-off your program in conjunction with other community events.
- make posters, pamphlets and fliers to publicize the event.
  Hang them up in school, in the community and see if local businesses will post them; get as many people to come as you can.
- invite performers to entertain and educate everyone about composting and other environmental issues.

These are just some suggestions; it's up to you to decide what would work for your school; get the students involved in the planning and see what they come up with. Getting them involved that way also will increase enthusiasm and participation.

Promoting Your Program

Once you have implemented your program and people have become accustomed to the routine, the program will start to run itself. However, to ensure that it continues to run correctly, you need to keep everyone enthusiastic and remember to recognize those who do a good job. Some ways to promote your composting program are:

- Provide compost T-shirts to volunteer students.
- Display charts to show everyone the progress being made and how many pounds of waste have been composted.
  Remember to keep these charts updated.
- Get local press coverage; contact school and neighborhood papers.
- Plan a celebration focusing on the use of compost.
  Have a tree planting!

Again, those are just a few ideas; do whatever works for you and your school; just be sure to recognize students (and teachers) who are really doing a good job and putting forth a lot of effort.

Good luck and happy composting!

GLOSSARY

aeration	Getting air into something by mixing or turning.
aerobic	1. When oxygen is present. 2. Organisms that can live only when oxygen is present.
amendment	A substance added to improve the condition of the soil.
anaerobic	1. When no oxygen is present. 2. Organisms that can live without oxygen.
basic composting	The mixing of browns and greens which through the help of micro and macro-organisms, breaks the materials down into compost.
bedding	Materials used as an organic medium for worm composting (e.g., newspapers and leaves).
biodegradable	Something that can decompose naturally.
browns	Carbon-rich materials (e.g., dry leaves, sawdust, shredded newspaper) that need to be mixed with greens to help the composting process.
cold-composting	Composting that is not hot, happens more slowly without turning of materials and can be without an ideal balance of browns and greens (2:1).
composting	Process of organic matter being broken down into a nutrient-rich soil or humus by decomposer organisms.
compost tea	Water that has been infused with the nutrients from compost.
decompose	To break down into basic compounds and elements.
decomposition	The process of breaking down organic matter into basic compounds and elements; includes nutrients needed for plant growth.
earthworms	A segmented worm belonging to the phylum Annelida.
greens	Nitrogen-rich materials (e.g., vegetable and fruit trimmings, coffee grounds, grass trimmings) that need to be mixed with browns to help the composting process.
hot-composting	Composting that is sped up by adequate volume of materials, turning of materials and proper brown/green ratio.
humus	Material that is formed by decomposition of organic matter; compost
invertebrate	Organisms without a backbone or spinal column.
microbe	see microorganism.
microorganism	Organism that is too small to be seen by the naked eye (i.e., bacteria).
mulches	An insulating material (wood chips, plastic) and plant residues (partially decomposed leaves) placed on top of garden beds and around plants to help soil retain moisture.
nightcrawlers	Large earthworms that come out at night.
nutrients	Things that nourish.
organic	Derived from plants or animals; living organisms.
pathogen	Organism that produces disease.
red worms	A variety of earthworm that works well for vermicomposting.
worm composting	Composting using worms; also known as vermicomposting.

APPENDIX A

Case Studies

Bret Harte Elementary School..A-1

Cesar Chavez Elementary School...A-2

Dr. Charles R. Drew Elementary School.....................................A-3

John Muir Elementary School..A-4

Lawton Alternative School...A-5

Rooftop Alternative Elementary School.....................................A-6

Tule Elk Park Children's Center...A-7

Dr. W. Cobb Elementary School..A-8

Case Study 1

Bret Harte Elementary School

Contact: (415) 330-1520

Bret Harte is located in the Bayview area and has 420 students in grades K–6.

How it started: The school has a garden that is used for Social Studies, Science, Math and Language Arts classes. The school was already composting with an Earth Machine, and one-third of the classrooms have worm bins that are used in the Science curriculum. It was easy to integrate worm composting when the garden was being replanted. Amy Taylor, while working at the school as part of the Urban Service Learning Project, took on this project.

System: One Earth Machine and three 4' x 2' x 1.5' worm bins, provided by SFRP.

Location: The garden is divided into twelve beds–one for each class. The worm bins are in the shade next to each set of beds so that each grade can care for a bin. The garden is in a secured area; the students need to be accompanied by an adult when visiting.

Collection: Two or three classes participate in food collection, but there is no set schedule, so students must be reminded when they have composting duty. The lunchtime monitor reminds students what item is to be composted as they enter the lunch area. A food composting bucket is placed next to the garbage cans, and students also carry buckets around the cafeteria and playground to collect food.

Outreach activities: The bins were delivered a few weeks in advance of the start of food collection. The bins were moved to the classrooms that would be participating so that the teachers and students could be taught how to set-up and care for the bins. (The SFRP and SLUG gave an introductory presentation.) The students and teachers then painted the bins.

Lessons learned: The program needed more structure and a fixed schedule of duties. The teachers wanted to be involved, but relied heavily on Amy. This made her very busy once the bins were set-up. The program would have run more smoothly if it had been started at the beginning of the year rather than in the middle—this would have given Amy and the teachers more time to try out different methods of collection. Amy also felt that more teachers were needed to help supervise so the responsibilities could be distributed more evenly. The outreach was limited to just three classes and Amy recommends an assembly and a large kick-off event for the whole school to get more people involved. Unfortunately, the worms in one of the boxes died after a month because they were fed too many citrus fruits; signs posted near the bins or printed on the collection buckets would help to remind teachers and students that large amounts of lemons and oranges are not good food for worms. Since the school lunch waste is limited in its amount of fresh fruits and vegetables, supplementing it with food from home at least once a month might be beneficial. Another option would be to have fewer bins. Schools should calculate the amount of food waste they generate; see "Determine What You Have to Compost" in Section 7.

Case Study 2

Cesar Chavez Elementary School

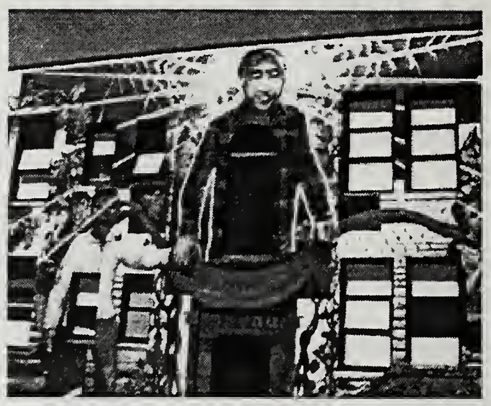
Contact: Rebecca Garcia-Gonzalez (415) 695-5765
Cesar Chavez is located in the Mission District and has 600 students in grades 1-5.

How it started: The program was initiated by three teachers in 1996; the school already had a garden. An Americorps volunteer at the school took over the program in 1997.

System: They started with ten 4' x 4' x 2' worm bins; five of the bins were cut down to 18" in height so that the smaller children could see and reach into them. They also cut the large, heavy lids in half and attached handles to them to make the bins easier to open and close. At the beginning of the second year of the program, it was decided that ten bins were too many for the amount that was being composted, so they removed three.

Location: The bins are in a large alley that is right outside the doors of the cafeteria and near the school's garden. This area is usually locked and requires adult supervision for access, isolating the program from the students somewhat which resulted in lower participation than was anticipated. Once the problem was recognized, the teachers worked with the janitorial staff to make it easier for the students to access the bins.

Collection: The program was set up in the spring of 1996 and many classes became involved with collection and feeding. However, during the 1996–1997 school year, the teachers' schedules were too busy to be involved and all the responsibilities fell to the Americorps volunteer. She was able to collect an average of 5–10 pounds of compostable food per week.



Outreach activities: Toward the end of the school year, Rebecca's class got more involved in the collection and feeding of the bins. She's been tracking the amount of food composted on a chart and posts it outside her classroom to give the program some publicity.

Use: The worm castings are used as fertilizer in the school's garden.

Lessons learned: In order to keep the students interested in the program, the bins need to be accessible to them. The Americorps volunteer arranged tours of the bins for classes to stimulate their interest. Toward the end of the school year, the teachers made a commitment to become more involved with the program and help with the coordination and maintenance of the program, relieving the Americorps volunteer of some of the responsibility. They also realized that they needed a team to run the program if the whole school was to be involved.

Case Study 3

Dr. Charles R. Drew Elementary School

Contact: Kathy Harriman (415) 330-1526
Charles Drew is located in the Bayview area and has 300 students in grades K–6.

How it started: The kindergarten has one worm bin and the school started a beautification committee that is interested in gardening.

System: Two 4' x 2' x 1.5' worm bins provided by the SFRP.

Location: The bins are in a courtyard adjacent to the cafeteria; it is a secure location that also shades the bins.

Collection: Three classes are involved in the collection; three to four students from one class are assigned duties that are rotated once a week. Two buckets used for collection are kept in the teachers' lounge; the students get the buckets and go through the cafeteria collecting fruit and vegetable scraps. The students feed the worm bins immediately after lunch, chopping up the larger pieces with a plastic knife; newspaper for the bins is kept in a bag next to the buckets and shredded as needed.

Outreach activities: The bins were delivered to the school a few weeks in advance of the start of food collection. The SFRP and SLUG gave an introductory presentation—the students helped shred newspapers and were taught to put the worms in the bins one handful at a time.

Lessons learned: Kathy was able to set a schedule right from the beginning that kept her coordination time to a minimum. The program was successful from the start because (1) the worm bins are right outside the cafeteria and (2) the students didn't need to be supervised in the courtyard.

Case Study 4

John Muir Elementary School

Contact: Sam McWilliams (415) 241-6335 John Muir is located in Hayes Valley and has 300 students in grades K-6.

How it started: The school's garden coordinator initiated the program in 1996 with a SFRP intern. The SFRP provided a small grant for materials.

System: Three 3' x 4' x 2' plywood worm bins were built by students with help from Yahoo! Compost Services, a local non-profit organization. The school is currently using one of the bins and plans to expand the program and incorporate the other two bins in the next school year. Two 4' x 4' x 4' basic bins (wood) are located in the garden which is a half-block away from the school.

Location: The bins are on school grounds at the front of the school; they are shaded by trees.

Collection: John Muir has two lunch periods, but food is only being collected during one. Fifteen students formed a "Worm Patrol" team that is identified by John Muir Worm Patrol T-shirts. During lunch two or three students monitor the garbage cans and 5-gallon food buckets in the cafeteria; the worm patrol is also in charge of feeding the worms. The food waste collected is evenly distributed between the basic and worm bins; garden trimmings and leaves from the garden are mixed in the basic bins as browns and greens. Each week, the garden coordinator takes approximately twenty students out to the garden.

Outreach activities: The SFRP intern organized a poster-making project with the students and hung the finished works in the cafeteria. The students also helped design the Worm Patrol T-shirt.

Use: The worm castings and compost are used as fertilizer and soil amendment in the school's garden.

Lessons learned: More adult supervision is recommended when starting a composting program. Once they had set up a routine and made sure the program ran smoothly, less supervision was needed. At the beginning, not much time was devoted to the program and it was delayed a few weeks. The Worm Patrol team had cohesion and identity, but needed more support to really be successful.

Case Study 5

Lawton Alternative School

Contact: TBA (new staff) (415)759-2832
Lawton is located in the Sunset District and has 500 students in grades K-8.

How it started: Lawton's Elementary Advisor, Carol Lanigan, initiated the composting program and put together a team that includes students, teachers, parent volunteers, a SLUG community composter and a friendly neighbor.

System: Lawton has two 4' x 4' worm bins and two Smith and Hawken Biostacks. The shredded newspaper that is used as worm bedding is stored near the bins. The City Parks and Recreation Department donated free woodchips to mix with the green materials in the Biostacks.

Location: The bins are in the school's garden which is down the hall from the lunchroom and outside. Though the area is not secure from the public, there have been no incidents of vandalism with the bins.

Collection: Teams of six students in grades 3–8 sign up to cover a two-week shift that involves monitoring, collecting food and feeding the worm bins. The buckets, scale, log book and gloves are stored nearby in the lunch area inside the school. First and second graders help by shredding newspapers for bedding. At the beginning of the two-week shifts, Carol meets with the student groups to go over their responsibilities. Other teachers and parents also help with the supervision of the students. In the 1996–1997 school year, Lawton composted an average of 49 pounds of material per week.

Feeding: The students are taught to break up the larger pieces of waste with a shovel before putting them in the bins. Sawdust and woodchips from woodshop classes are used to cover the materials in the worm bins and Biostacks. The sawdust is kept next to the bins in its own container.

Outreach activities: Most of the students learned about the composting program from some fifth graders who went around to the other classes and explained the food waste collection process and why they should compost. During the first week of collection, the staff and other volunteers set up an exhibit on composting near the garbage and food waste cans during each lunch period to make everyone aware of the program.

Use: The compost is used in the school's garden and landscaping.

Lessons learned: The success of this program relies heavily on the amount of support it gets from school staff, administration and students; there is a lot of promotion going on. Carol Lanigan organizes a meeting every few weeks to keep everyone updated; this helps keep everyone motivated and involved.

Case Study 6

Rooftop Alternative Elementary School

Contact: Beverly Koenig (415) 695-5691
Rooftop Elementary is located in Upper Market and has 340 students in grades K–6.

How it started: Rooftop has a well-established and vibrant garden that all the classes use. Three teachers initiated the composting program and received a lot of support from parents, volunteers and a SLUG community composter.

System: They have three 4' x 4' x 2' worm bins that are fed fruit and vegetable scraps. There are also several basic composting bins for garden trimmings.

Location: Since the school doesn't have an indoor cafeteria, the students eat in the garden area, located in the center of the school; this is where the bins are. The students frequently wander over to the bins to look at the worms which encourages hands-on learning and participation.

Collection: Students pull a small cart with two 5-gallon buckets around the garden at lunchtime to collect the food waste; these duties are rotated between two classrooms and supervised by teachers and parent volunteers. An average of 15–20 pounds of food waste is collected each week.

Outreach activities: The teachers organized a short play. Students dressed in composting costumes explained the composting process. Over sixty people came to the school on a work-day in the fall for a pot-luck party to kick-off the program.

Use: The worm castings and basic compost are used in the school's garden.

Lessons learned: The teachers from the two classes that were collecting the food needed more help with supervision; the students did a great job collecting, but needed to be supervised to make sure that they were keeping records and maintaining the bins. Participation is done without a lot of fanfare since the program has been in existence so many years and nearly runs itself.

Case Study 7

Tule Elk Park Children's Center

Contact: Holly Landsbaum (415) 749-3588
Tule Elk is located in the Marina and has 200 students in grades Pre-K–3 and two Special Ed classes.

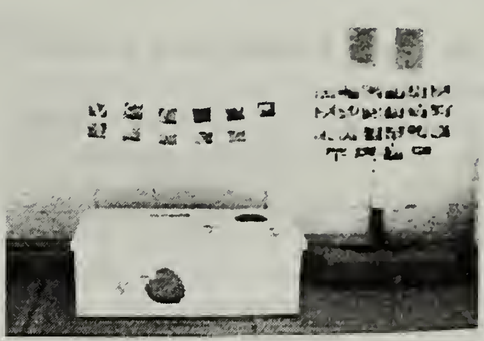
How it started: The school already had a garden and Holly, the garden coordinator, had learned about composting when she was a part-time assistant at Cobb School.

System: Holly and a parent built two 4' x 2' x 1.5' worm bins.

Location: The bins are located a few feet outside of the garden area where they receive some shade from the hot, afternoon sun. Holly hung color copies of worms from Adrienne Soutter Perrot's book *Earthworms* on the wall behind the bins. A collage of photos from "Worm Day" are also above the bins.

Collection: No system is in place now; Holly plans to work on a schedule with teachers over the summer.

Outreach activities: Holly and another teacher created a puppet show on worm composting and showed it to each of the classrooms; they even sang a composting song. The SFRP purchased 10 pounds of worms for the program and Holly coordinated a "Worm Day" to welcome the worms and get the students comfortable with them. To do this, Holly went to each classroom with some worms and had the students dip their hands in water and touch the worms; this gave them hands-on experience with the worms and taught the students that worms breath through their moist skin. Many classrooms got ready for Worm Day on their own—one class made a worm out of butcher-block paper and finger paint and paraded it in the yard on Worm Day; another class made snacks out of Oreo crumbs and gummy worms that were shared during the celebration.



Lessons learned: Tule Elk was very successful in getting the whole school interested and excited about the program; the individual classroom presentations gave the students wonderful hands-on experience with the worms. As a result of Holly's efforts, the whole school is very supportive of the program.

Case Study 8

Dr. W. Cobb Elementary School

Contact: Jessica Login, (415) 749-3579
The Cobb school is located in lower Pacific Heights and has 280 students in grades K–6.

How it started: The Cobb/Summerbridge Garden Project is in its third year; it provides garden classes to Cobb students and the children who participate in the Summerbridge programs. The Garden Project is redeveloping the garden space and with grade-specific curriculum that accommodates one class at a time. Jessica is the project's full-time director and is assisted by a part-time teacher.

System: The school had three 2' x 1' worm bins and one Earth Machine; the SFRP provided them with two additional worm bins (4' x 2' x 1.5') and a three-bin basic composting system. The three-bin system will be used to compost Cobb's large volume of garden trimmings.

Location: The bins are shaded by trees and located in the center of the garden, next to the playground, which is fenced and locked . The students and teachers painted the bins with brightly colored pictures of fruit, vegetables and worms. The bins also double as benches when Jessica teaches her garden classes.

Collection: The school already had a lunchroom clean-up system involving four students; Jessica plans to have a fifth student monitor the composting collection. The composting collection responsibilities are posted on a poster in the cafeteria. The supplies, tracking binder, scale and bucket are set out by a student; the food bucket is set up on the scale, next to the garbage cans in the middle of the cafeteria. The student then goes around to the tables, announcing what can be composted from that day's lunch. Jessica calculated that no more than 1.5 pounds of food should be fed to the bins each day, so the monitor is instructed to remove the bucket at that weight. The garden has a bin for each day of the week, and Jessica supervises to be sure that the correct bin is being fed; she has to unlock the door for the students, and they must be supervised while in the garden. This garden access system requires Jessica to spend a lot of time supervising, so collection is possible only three days a week.

Outreach activities: The bins were delivered a few weeks before the program was to start so that the teachers and students could paint and weather-seal them. The SFRP and SLUG joined Jessica and her assistant in showing the upper grades the worm bins. The bins were placed in the cafeteria for the presentation in which Jessica and her assistant role-played the collection duties. The students were then introduced to the worms and taught how to feed and care for them.

Lessons learned: This is a time-consuming project and Jessica needs more teachers to get involved and help with supervision.

APPENDIX B

Literature and Resources

Literature and Related Resources....B-1
Teacher Resources....B-1
Curricula....B-1
Books for Kids....B-2
Newsletters....B-3
Audio Cassettes....B-3
Videos....B-3
Tours....B-4
Hotlines....B-4

Literature and Other Related Resources

The San Francisco Recycling Program School Education Resource Library makes many of the following resources available to San Francisco educators. The library is located at 1145 Market Street, Suite 401 between 7th and 8th Streets; call them at (415) 554-3400 or fax (415) 554-3434 to arrange a loan of resources (there is a $25 refundable deposit). Materials can be mailed free of charge to SFUSD schools through the district mail system.

Teacher Resources

Backyard Composting, Your Complete Guide to Recycling Yard Clippings, Harmonious Technologies Press: Ojai, CA (1992).

Let It Rot – The Gardener's Guide to Composting, Stu Campbell. Storey Communications, Inc. (1990).

The Rodale Book of Composting: Easy Methods for Every Gardener, Rodale Press (1992).

Worms Eat My Garbage, Mary Appelhof. Flower Press: Kalamazoo, MI (1982).

Worms, Worms and More Worms: A Guide to Vermicomposting, (1996).
Available at no charge; contact the CA Integrated Waste Management Board at (916) 255-2385.

Curricula

Composting Across the Curriculum: A Teacher's Guide to Composting, Tahara Ezrahti and the Marin County Office of Waste Management, (1993).
Uses activities to connect composting to social studies, language arts, math, science, fine arts, music and physical education. Ages 7-adult, 118 pages, $8.50; contact the Marin County Office of Waste Management, 10 N. San Pedro Road, Suite 1022, San Rafael, CA 94903-4155, (415) 499-6647 for ordering information.

Composting: Wastes to Resources, Cornell Cooperative Extension (1990).
An outdoor composting guide for grades K-12; includes posters and activities. $7.70 from Media Services Distribution Center, 7 Cornell Business and Technology Park, Cornell University, Ithaca, NY 14850, (607) 255-2080.

Creepy Crawlies for Curious Kids, (#217), Lynn Ransford. Teacher Created Materials, Inc. : Sunset Beach, CA (1986).

Critters, AIMS Education Foundation (K-6). AIMS Program Publications, Fresno Pacific College, P.O. Box 8120, Fresno CA 93747-8120.

Critters in the Classroom, Robert W. Smith (The Science Series, Grades 1-2 and 3-4). Instructional Fair, Inc.: Grand Rapids, MI. (IF8504–Grades 1-2; IF8505–Grades 3-4).

Curricula, cont...

Do the Rot Thing. A Teacher's Guide to Compost Activities, Alameda County Waste Management Authority & Source Reduction & Recycling Board: San Leandro, CA (1997).

80 pages; free for educators in Alameda County. Contact ACWMB at 777 Davis Street, Suite 200, San Leandro, CA 94577, (510) 614-1699.

Earthworms: Nature's Recyclers, J. Breckenridge (Grades K-6). Harmony Foundation: Ottawa, Ontario, Canada (1992).

Earthworms Teacher's Guide, Robert Knott, Kimi Hosoume and Lincoln Bergman (Grades 6-10). Great Explorations in Math and Science, Lawrence Hall of Science, University of California Berkeley, Berkeley, CA 94720 (1989).

Exploring the Structure of Earthworms, The Art and Science Connection: "Hands On Activities for Primary Students," Kimberly Tolley. Addison-Wesley Publishing Co.: New York, NY (1993).

Pages 23-26.

Getting Hooked on Worms, Grow Lab: "Activities for Growing Minds," National Gardening Association, 180 Flynn Ave., Burlington, VT 05401 (1990).

Pages 214-221.

The Wonderful World of Wigglers (A Common Routes Guidebook), Julia Hand. Food Works: Montpelier, VT 05602 (1995).

Worms Eat Our Garbage, Classroom Activities for a Better Environment, Mary Appelhof, Mary Frances Fenton and Barbara Loss Harris. Flowerfield Enterprises: Kalamazoo, MI (1993).

Integrates earthworm activities with soil science, plant growth studies, ecology issues, art, language arts and more; has reproducible charts.

Books for Kids

Adventures in the Underworld, Anna Scott Draper. Terra Publishing: Dunnville, Ontario, Canada (1998).

Amazing Dirt Book, The, Paulette Bourgeois. Addison-Wesley: Menlo Park, CA (1990).

Annelida The Wonder Worm, Katie B. Diepenbrock. Sagattarian Press: Oakland, CA (1991).

Busy Little Gardener, Helen Barden. Conran Octopus Ltd.: London (1990).

Compost Heap, The, Harlow Rockwell. Doubleday & Co.: New York, NY (1974).

Earthworm (My First Nature Book), Andrienne Soutter-Perrot and Etienne Delessert (illustrator). American Education Publishers (1994).

Earthworms, Catherine O'Neil. "Ranger Rick," National Wildlife Federation: Vienna, VA (1990).

Earthworms, Keith Pigon and Marilyn Woolley. Modern Curriculum Press: Cleveland, OH (1989).

Books for Kids, cont...

Earthworms: Keeping Minibeasts, Chris Henwood. Franklin Watts: New York, NY (1988).

Earthworms, Dirt and Rotten Leaves: An Exploration in Ecology, Molly McLaughlin. Macmillan Publishing: New York, NY (1986).

Gardens From Garbage, Judith F. Handelsman. The Millbrook Press: Brookfield, CT (1993).

Growing Ideas, Jean van Leeuwen and David Gavril (illustrator). Richard C. Owen Publishing. (1998).

Grow Lab: A Complete Guide to Gardening in the Classroom, National Gardening Association: Burlington, VT (1988).

How to Eat Fried Worms, Thomas Rockwell. Dell Yearling/Bantam Books. (1973).

Scavengers and Decomposers: The Clean-up Crew, Pat Hughey. Macmillan, New York, NY (1984).

Squirmy Wormy Composters, Bobbie and Janine Schaub. Crabtree Publishing: New York, NY (1992).

Wonderful Worms, Linda Glaser. The Millbrook Press: Borrkfield, CT (1992).

Worms, Lois and Louis Darling. William Morrow: New York, NY (1972).

Worms of Kukum Lima, The, Daniel Pinkwater. P. Dutton: New York, NY (1981).

Newsletters

Worm Digest, Box 544, Eugene, OR 97440-9998.
$12.00/year (4 issues).

Audio Cassettes

Dirt Made My Lunch, Banana Slug String Band, P.O. Box 2262, Santa Cruz, CA 95063.

Squirming Worms, KidsSongs Jubilee, Nancy Cassidy. Klutz Press: Palo Alto, CA (1990).

Videos

Home Composting: Turning Your Spoils to Soils, produced by CT Environmental Protection & Recycling Program.
Grades 7-12, 17 minutes.

Living Soil...Exploring Soil Science and Sustainable Agriculture with Your Guide, The Earthworm, The, Iowa State University: Ames, IA (1993).
126 page book + video that provides curriculum that includes lab and field exercises. The video shows agriculture's impact on the living soil from a worm's point of view. $49.00 + $4.90 S&H; Agricultural Education and Studies, Iowa State University, 201 Curtis Hall, Ames, IA 50011-1050, (515) 294-0045.

Videos, cont...

Magic of Composting, The, produced by the Recycling Council of Ontario, 489 College St. #504, Toronto, Canada M6G 1A5, (416) 960-1025.

Organic Gardening, produced by Rodale Press/Bullfrog Films, Inc.
Grades 4-12, 30 minutes.

Turning Garbage Into Gold: An Introduction to Vermiculture Biotechnology, produced by Bhawalkar Earthworm Research Institute, Pune, India.
Grades 4-12, 30 minutes.

Wormania!, produced by Mary Appelhof.
Plus four worm songs by Billy B. Brennan; grades 4-6, 26 minutes.

Tours

San Francisco League of Urban Gardeners (SLUG)
2088 Oakdale Avenue
San Francisco, CA 94124
(415) 285-7584
Demonstration gardens, community composter/green gardening program, compost hotline (Rotline), low-cost bins and school programs available.

Sanitary Fill Garbage Transfer Station and Recycling Center
501 Tunnel Avenue (near 3-Com Park at Beatty Road)
San Francisco, CA 94134
(415) 330-1400
Here students can see nearly 5 million pounds of garbage and the sorting of recycled materials.

Hotlines

California Statewide Recycling/Composting Hotline: (800) 553-2962

SLUG Rotline: (415) 285-7585

San Francisco Recycling Hotline: (415) 554- 7329

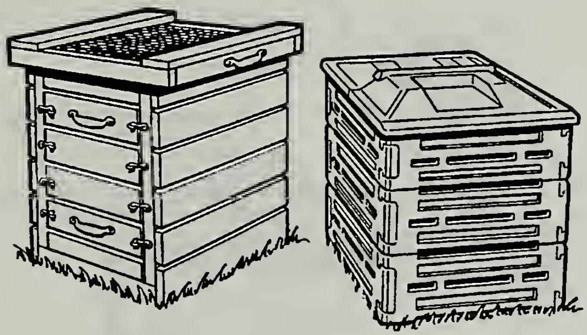
APPENDIX C

Troubleshooting

Basic Bins C-1

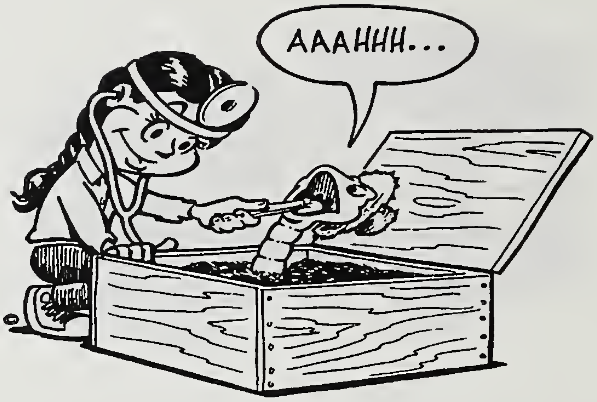
Worm Bins..C-2

Basic Bins



Symptoms	**Causes**	**Solutions**
Not composting	• Too dry • Too much dry, woody material • Too wet • Not enough air	• Moisten until damp • Turn pile, moisten and/or add more food waste and green grass clippings
Smells rotten	• Too wet or not enough air	• Turn pile and/or add more dry browns
Attracting flies, rodents or other animals	• Non-compostables present (e.g., meat, dairy, oils) • Not covering food waste well • Holes in bin that animals can fit through • Too much fruit	• Turn pile and remove meat, grease, etc. • Cover food with dry browns • Rodent-proof bin by covering holes • Stop adding fruit until most of the original material has decomposed

Worm Bins



Symptoms	Causes	Solutions
Worms are dying	Not enough food	Add food and bury it under bedding
	Bin too dry	Add water until damp
	Bin too wet	Add shredded paper or dry leaves
	Bin too hot	Put bin in shade
	Too many castings	Harvest compost and add fresh bedding
Smells rotten	Not enough air circulation	Add fresh bedding Turn pile Check to see if there are enough bin holes letting air in; add more if necessary
	Food exposed	Spread food out more evenly
Flies in bin	Too much fruit	Secure lid, add bedding to cover food then cover worms and bedding with plastic or burlap Stop adding food until most of the original material has decomposed
Ants in bin	Too dry	Add water

APPENDIX D

Charts and Signs

Bin Record Sheet D-1

Volunteer Chart D-2

Yes/No Signs D-3

School____________________ **Compost Bin Record Sheet** Bin #____________________

Date	Classroom	Pounds Put in Bin	Kinds of Food Put in Bin	Enough Bedding?	Wet Enough?	Too Wet?	Smell? Comments
Total							

Volunteer Chart

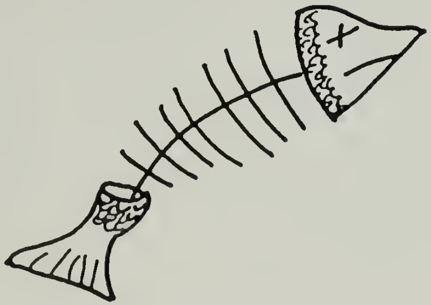
Use this chart to work out a collection, bin feeding and maintenance duty schedule for at least one month to see if you have adequate support for your composting program.

Week of	**Supervisor**	**Student Volunteers**	**Special Duties**
		Class ______:	
		Class ______:	
		Class ______:	
		Class _____:	

COMPOSTING

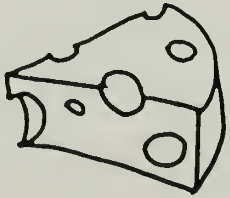
YES:

Apples, Banana Peels, Oranges, Celery, Carrots, Lettuce,



NO:

Meat, Bones, Cheese, Oily foods, Cans or Bottles



APPENDIX E

Blueprints and Resources

Tilth Worm Composting Bin E-1

Worm Bin E-3

Urban All-Wood Bin........E-3

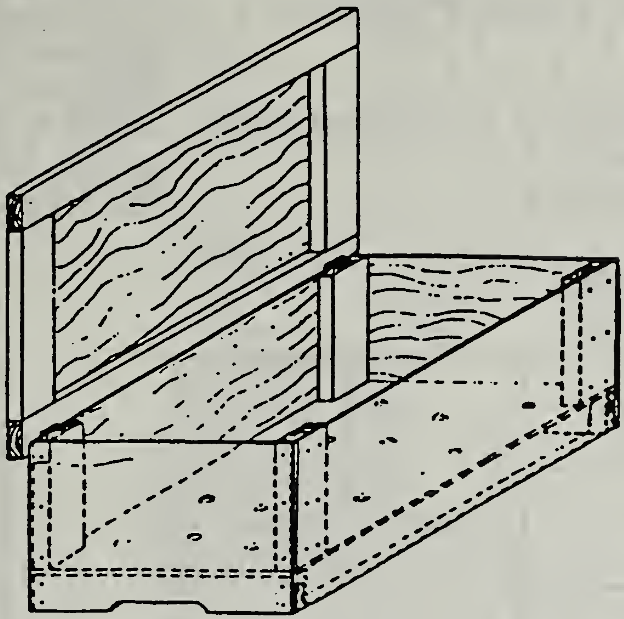
3-Bin Composter E-4

A Selection of Commercial Sources E-5

Purchasing Worms........E-6

Additional Materials E-6

TILTH WORM COMPOSTING BIN



This system is designed for composting vegetable food wastes using red worms. Food wastes and worms are "bedded" in moist shredded newspaper, cardboard, sawdust or brown leaves. The worms turn both food wastes and bedding into a high-quality compost suitable for use on house plants, seedlings or general garden use.

To maintain this system simply rotate burial of food wastes throughout the bin. Every 3-6 months compost should be moved to one side of the bin and new bedding added to the empty half. At this time start burying wastes in the new bedding only. Within one month worms will populate the new bedding, finished compost may be harvested and the rest of the bin can be rebedded. Worm bins can be kept outside, or in a cool indoor space such as a basement or garage. Make sure your bin is full of bedding and located in a protected area to keep your worms from freezing in winter. A properly maintained worm bin is odorless. Bins may be placed in a shady outdoor space the remainder of the year. Flies may be controlled by placing a sheet of plastic over the bedding.

This bin can be built for about $30-50, depending on the type of wood used. Worm bins can also be made from recycled materials, wooden boxes, or other containers. Any worm bin must have drainage in the bottom and a tight fitting lid to keep moisture in and pests out. A starter batch of worms can be purchased at a small additional cost, or find some in an old compost pile! Seattle Tilth sells red worms at the Backyard Composting Demonstration site or call the Compost Hotline for other sources of worms. For more information see Mary Appelhof's book, Worms Eat My Garbage and the "Easy Composting of Food Waste" brochure, also available from Seattle Tilth.

The Master Composter Program is sponsored by Seattle Tilth Association and the Seattle Solid Waste Utility. Call the Compost Hotline at 633-0224 for more information about composting and recycling.

This recycled paper is recyclable.

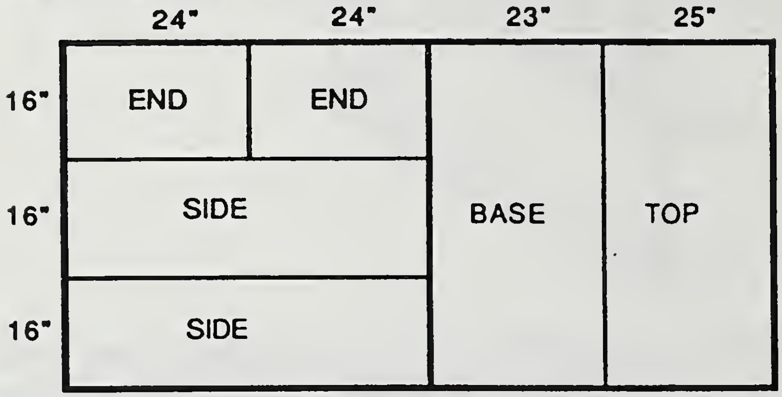
Materials:

1 1/2" sheet of exterior plywood or chipboard
1 14' utility 2x4
1 16' utility 2x4
1/2 lb. 4d galvanized nails or 1-1/4" drywall screws
12. 16d galvanized nails
2 3" galvanized door hinges

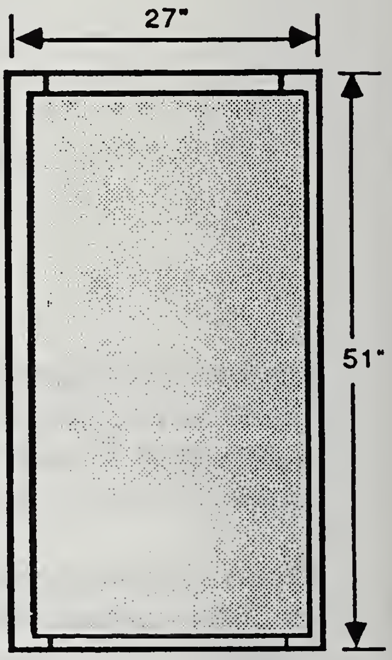
Tools:

Tape measure, skill saw or rip hand saw, hammer, saw horses, long straight edge or chalk snap line, screwdriver, and drill with 1/2" bit.
Use eye and ear protection.

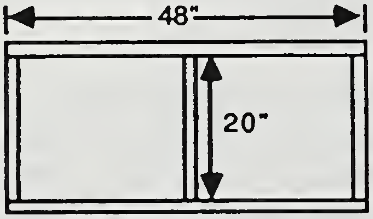
Construction Details:



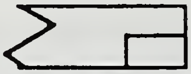
4' X 8' SHEET OF 1/2" PLYWOOD



TOP LID 2 X 4 FRAME
WITH PLYWOOD COVER



BASE FRAME 2X4s ON EDGE



END VIEW OF
LAP JOINT

Measure and cut plywood as indicated in drawing above. To make the base, cut the 14' 2x4 into five pieces: two 48" and three 20" long. The remaining 12" piece will be used to make the sides. Nail the 2x4s together on edge with two 16d nails at each joint as illustrated in the Base Frame diagram. Nail or screw the plywood base piece onto the 2x4 frame using the 4d nails or drywall screws

To build the box, cut three 12" pieces from the 16 foot 2x4. Place a one foot 2X4 under the end of each side panel so that the 2X4 is flush with the top and side edges of the plywood, and nail the boards into place. Nail or screw the side pieces onto the base frame. To complete the box, nail the ends onto the base and sides. To reinforce the box place a nail or screw staggered every 4-6 inches wherever plywood and 2x4s meet. Drill twelve 1/2" holes through the bottom of the box for drainage.

To build the lid, take the remaining 16 foot 2x4 and cut it into two 51" pieces and two 27" pieces. Cut and chisel lap joints in the corners, then glue and nail or screw the frame together. Center the plywood lid on the 2X4 frame and attach with 4d nails or 1-1/4" screws. Position hinges on the lid so that screws will attach to 2X4s on the box frame. Attach hinges on the under side of the 2x4 lid frame, then place lid on box and attach.

WORM BINS

- For fruit & vegetable trimmings
- For indoors or outdoors, very compact
- Most fun! (See *Composting Fruit & Vegetable Trimmings* brochure)
- Produces small amounts of excellent fertilizer

1-PERSON PLASTIC WORM BIN

- Very easy to build; tidy for indoor use
- Plastic bins keep compost moist—will require regular additions of dry bedding
- $6 – $20 for new materials

MATERIALS

◆ (1) Plastic storage container with a tight-fitting lid—min. 10" tall, 12"x24" base

TOOLS

Power drill with 1/4" bit or utility knife

ASSEMBLY

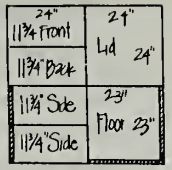
For indoor use, drill several holes for ventilation about half-way up the sides of the bin. For outdoor use, holes can be drilled in the bottom for ventilation and drainage. If you are using a utility knife to make holes, cut out triangles 1/4" or smaller.

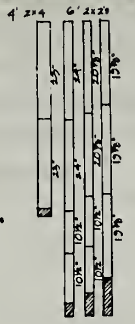
2-PERSON WOODEN WORM BIN

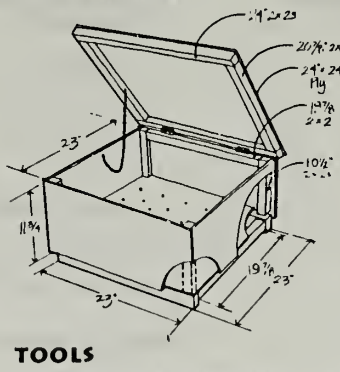
- Basic carpentry skills needed for construction
- Doubles as a seat!
- Breathes well—will need occasional watering
- $20 – $30 for materials new

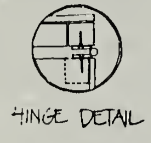
MATERIALS

- ◆ (1) 4'x4' piece 1/2" exterior-grade plywood
- ◆ (3) 6' pieces 2x2" wood
- ◆ (1) 4' piece 2x4" wood
- ◆ 1 lb. 4-penny galvanized nails
- ◆ 16" light chain with (2) 1/2" wood screws
- ◆ (2) 2" hinges, with 3/4" wood screws
- ◆ Waterproof wood glue









Based on design by City Worms & Compost

TOOLS

Power saw (use eye protection) or hand saw, hammer, measuring tape, pencil, square, drill with 1/4" and 3/32" bits, sandpaper

ASSEMBLY

Glue all wood pieces before nailing.

1. Base: Nail the two 23" 2x4s and two 19-7/8" 2x2s to bottom of 23x23" plywood as drawn. Drill several 1/4" holes for drainage.

2. Side, front & back walls: Nail the four 2x2 uprights to the two side walls along the 11-3/4" edge, with one end of each 2x2 flush with the top edge of the walls. Nail a 19-7/8" 2x2 hinge support to the top edge of the back wall piece, leaving 1-1/2" on each side for 2x2 uprights. Assemble box by nailing the 1-1/4" overhang of the side walls to the 2x2s on the base as drawn. Then nail the front and back walls to the 2x2 uprights and to the 2x4s on the base as drawn. Be sure the hinge support is at the top of the bin.

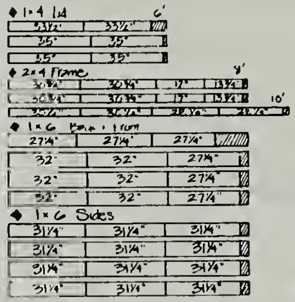
3. Lid: Nail lid together as drawn. Attach to box with hinges, making sure to pre-drill screw holes into the 2x2s, and position hinges as in detail. Attach chain with 1/2" wood screws so lid can rest in an opened position.

URBAN ALL-WOOD BIN

- For fruit, vegetable & yard trimmings
- For "No-Fuss" or "Mixed" compost (see *Basic Composting* brochure)
- Has 2 front doors for easy harvesting and turning, a top that doubles as a sifter, & a full wire-mesh lining
- Produces small to large amounts of compost
- Carpentry skills needed for construction
- $100 – $120 for new materials

MATERIALS

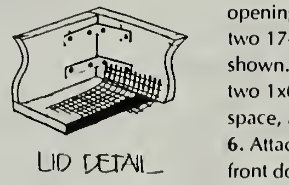
- ◆ (8) 8' 1x6 wood*
- ◆ (2) 8' 2x4 wood
- ◆ (1) 10' 2x4 wood
- ◆ (3) 6' 1x4 wood
- ◆ 15' 1/4" wire mesh hardware cloth
- ◆ (4) 5" drawer handles
- ◆ (8) 1-1/2" hooks & eyes
- ◆ (8) 4" corner brackets with 1/2" wood screws
- ◆ Waterproof wood glue
- ◆ (20±) 8 penny galvanized nails
- ◆ (125±) 6 penny galvanized nails—*or, screws and a power drill-driver can be used instead*
- ◆ (250±) 3/4" poultry wire staples



*Bin dimensions based on planed wood

TOOLS

Power saw (use eye protection) or handsaw, screwdriver, hammer, measuring tape, pencil, square, drill with 1/16" bit, sandpaper

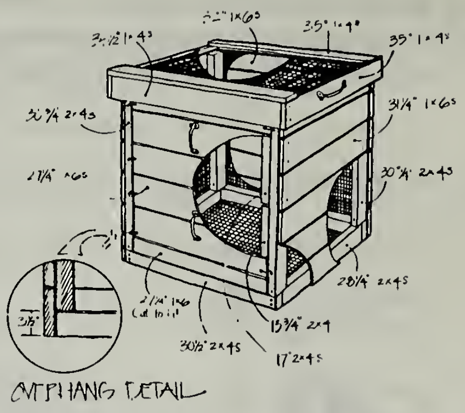


ASSEMBLY

Glue all wood pieces before nailing.

1. Nail 2x4 bottom frame together with the larger nails. Be sure the finish dimension is 30-1/2x31-1/4".

2. Build sides by nailing bottom and top 31-1/4" 1x6s to the 2x4s (use smaller nails). Be sure bottom 1x6s hang down 3-1/2" below 2x4 uprights (see overhang detail). Fill in the remaining 1x6s equally spaced, with no gaps larger than 1/4".



3. Attach sides to base by nailing 3-1/2" overhang to base as drawn (with smaller nails). Toenail 2x4 uprights into bottom frame with larger nails.

4. Nail the six 32" 1x6s to back by first attaching the top and bottom pieces, then filling in the remaining four, spaced equally.

5. Before cutting pieces for the front doors, measure the actual opening at the front of the bin, and make sure to cut the 1x6s just 1/8-1/4" smaller than the opening. Build top door by nailing three 1x6s to the two 17-3/4" 2x4s with 1/4" between each board as shown. Build bottom door by first nailing on the top two 1x6s (1/4" apart), then measuring the remaining space, and cutting the last 1x6 lengthwise to fit.

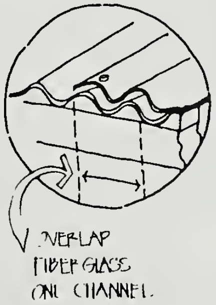
6. Attach eyes to front 2x4 uprights, and hooks to front doors as drawn.

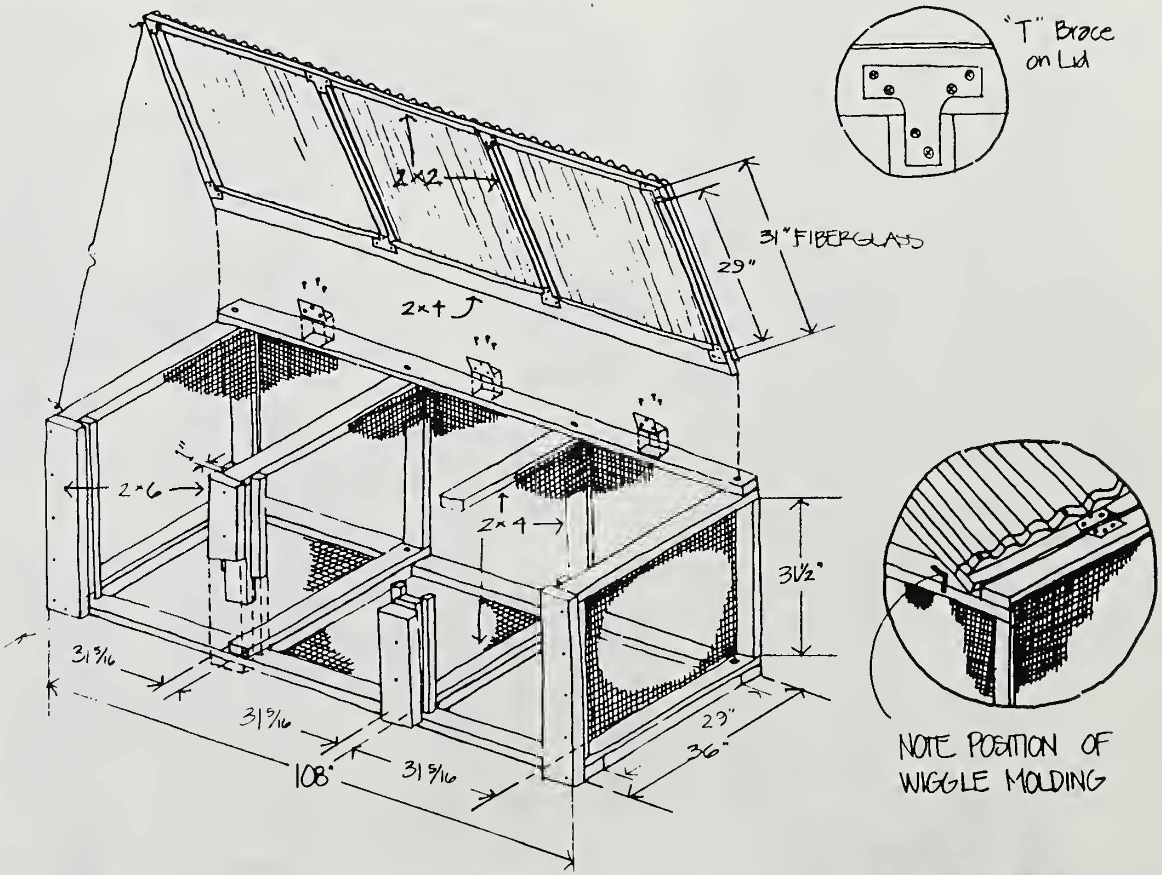
7. Build lid by pre-drilling and tacking together as drawn (using smaller nails), making sure the finished dimension is 35x35" and square. Then pre-drill and screw the corner brackets to the inside corners, and the top 1x4s into place. Cut a 33x36" piece of wire screen and staple it in as shown in detail drawing.

8. Cut remaining screen to fit—staple side, back and door pieces inside bin on 1x6s (not over 2x4s). Staple bottom piece onto the underside of bin.

3-BIN COMPOSTER

- For yard trimmings (and fruit & vegetable trimmings if well maintained)
- Requires min. 3'x9' of yard space
- For "No-Fuss" or "Mixed" compost (see *Basic Composting* brochure)
- Excellent for hot composting—has removable front slats for easy turning, and separate bins for turning and aging compost, and/or storing compostables
- Can handle large amounts of compostables
- Carpentry skills needed for construction
- $175 – $200 for new materials





Based on design by Seattle Tilth

MATERIALS

- ◆ 2x4" wood*: (8) 31-1/2", (8) 36", (4) 9', and (4) 29" pieces
- ◆ 2x6" wood: (4) 36" pieces
- ◆ 2x2" wood: (6) 34-1/2", (1) 9', and (4) 29" pieces
- ◆ 1x6" wood: (19) 31" pieces
- ◆ 1/4" mesh hardware cloth: 30'x3'
- ◆ Carriage bolts (3-1/2"x3/8"): 12, with washers & nuts
- ◆ 12 penny galvanized nails: 2 lbs.
- ◆ 8 penny galvanized nails: 1 lb.
- ◆ Poultry wire staples: 1 lb.
- ◆ Corrugated fiberglass (4 oz.): (2) 8'x26" pieces
- ◆ Gasketed roofing nails: (40)
- ◆ Wiggle molding: 18 feet
- ◆ 3" hinges (zinc-plated, galvanized or brass): (3)
- ◆ 4" flat corner braces: (4), with 1" wood screws
- ◆ 4" flat "T" braces: (4), with 1" wood screws
- ◆ (4) hook eyes, and 8' of strong twine or chain

*Bin dimensions based on planed wood.

TOOLS

Power saw (use eye protection) or hand saw, drill with 3/8" and 1/16" bits, screwdriver, hammer, tin snips, tape measure, pencil, socket or wrench, carpenter's square

TWO-BIN ADAPTATION

You can make a two-bin composter for a smaller yard by carefully adapting the materials list, drawings, and

ASSEMBLY

Main structure: Butt-nail two 31-1/2" and two 36" 2x4s together with 12-penny nails to form each of four screen dividers. Cut four 36x33-1/2" wire mesh pieces, and staple (every 4") to frames after checking frames for squareness. Bolt dividers to three 9' 2x4s as shown (inside measurement between dividers should be 31-5/16"). Tack in 29" 2x4s as shown. Staple one 9'x3' piece of wire mesh (every 4") to back of structure, and one 9'x3' piece to the bottom.

Slats and slat tracks: Nail 2x6s to front of dividers. Nail 34-1/2" 2x2"s onto frames as shown. Leave at least 1" for the slats to slide in. The last slat of each

Lid: Assemble lid frame as shown, with flat corner and "T" braces on the bottom side. Pre-drill nail holes every couple of feet into wiggle-molding humps, and attach molding to 9' 2x2 and 9' 2x4 with 8-penny nails. Note position of wiggle molding on 2x4 in drawing. Cut fiberglass into five 32" pieces with tin snips. Pre-drill fiberglass and wiggle molding on top of every third hump, and nail together with gasketed nails. Be sure to overlay fiberglass pieces at least one channel wide, and before attaching the last piece, trim off excess fiberglass. Attach lid to frame with hinges. Attach heavy-duty twine or chain to lid and main frame with hook-eyes as shown (to prevent lid

BUILDING MATERIALS

SALVAGED LUMBER AND CONTAINERS

Building Re:Sources
701 Amador Street
San Francisco,
(415) 285-7814

Caldwell Building Supplies
195 Bayshore Blvd. in San
Francisco, (415) 550-6777

Urban Ore 7th & Gilman St.
in Berkeley, (510) 559-4460

Construction sites often have lots of scrap lumber for free. Ask for permission, watch for nails, and be careful!

NON-TOXIC WOOD PRESERVATIVES

To preserve untreated wood, seal annually with linseed oil or shellac (available widely), or "Penetrating Water Seal" from **Earthsake, 1** Embarcadero Center and 2706 Chestnut St., in San Francisco, (415) 441-2896. Pressure treated wood leaches toxins into compost and soil—avoid it, or be sure to paint it.

WIRE-MESH FENCING & HARDWARE CLOTH

Most hardware stores and lumber yards carry wire mesh hardware cloth or other sturdy fencing material.

PLASTIC BINS FOR WORMS (RETAIL)

Most hardware, office supply and discount supply stores carry an assortment of plastic storage containers. Look for ones with tight-fitting lids.

PLASTIC GARBAGE CANS & SALVAGED DRUMS

Reuse an old 32-gallon or larger garbage can or pick one up at a hardware store—the more heavy-duty, the better. For salvaged plastic drums call **Containers Unlimited**, 10901 Russet St., Bldg. #2 (at 105th Ave.), in Oakland, (510) 430-0503.

A SELECTION OF COMMERCIAL BIN SOURCES

BIN	RODENT-RESISTANT?	DESCRIPTION	RETAIL PRICE*	SOURCES
Avant Garden	yes	Cubical worm bin with spigot, plastic	$48.00	Avant Garden P.O. Box 1047 Pt. Reyes, CA 94956, (415) 663-1975
Biostack	yes/no	Cubical, plastic, w/ or w/o floor	$89	Smith & Hawken 35 Corte Madera Ave. Mill Valley, CA 94941, (800) 776-3336
Can-O-Worms	yes	Cylindrical, 100% recycled plastic, stacking worm bin	$99.50-119	Green World Mercantile 2340 Polk St. S.F., CA (415) 771-5717; Sloat Garden Centers 3427 Wawona St. S.F., CA (415) 566-4415; Viscor Distrib. Inc. 12165 Cherrywood Dr. Maple Ridge, B.C., Canada V2X 0B7, (800) 609-1223
ComposTumbler	yes	Steel rotating drum, 2 sizes	$299–379	Home Gardening Mfg. Co. 30 Wright Ave. Lititz, PA 17543, (800) 880-2345
Earth Machine**	yes/no	Cylindrical, plastic, w/ harvest door w/ or w/o floor	**$19.50-90**	***San Francisco's '97-'98 Bargain Compost Bin, just $19.50 to S.F. residents! See below.*** Norseman Plastics 2296 Kenmore Ave. Buffalo, NY 14207, (800) 267-4391
Epic Composter	yes/no	Cubical, 100% Recycled plastic w/ or w/o floor	$65	Epic Plastics 1880 Garden Tract Rd. Richmond, CA 94801, (510) 235-9339
Garden Gourmet	yes/no	Cubical, plastic, w/ harvest door (use 1/4" wire mesh for floor)	$69–79.95	ENVIRO CARE P.O. Box 981 Pacific Grove, CA 93950, (800) 889-7238
Green Genie (Bonar)	yes	Cylindrical, plastic, w/ harvest door	$125	Natural Gardening Co. 217 San Anselmo Ave. San Anselmo, CA, (415) 456-5060
No-Turn Compost Bin	yes	Cylindrical, 100% recycled plastic, w/ air tubes	$110	Natural Gardening Co. 217 San Anselmo Ave. San Anselmo, CA, (415) 456-5060; Gardener Equipment Co. Inc. P.O. Box 106 Juneau, WI 53039, (800) 393-0333
Rubbermaid Composter	no	Cubical, plastic, w/ harvest door	$119	Goodman Lumber 445 Bayshore Blvd. S.F., CA (415) 285-2800
Seattle Composter	yes/no	Cylindrical, 100% recycled plastic w/ or w/o lid and floor	$69.95–84.95	RPM 2829 152nd Ave. NE, Redmond, WA 98052, (800) 867-3201
SoilMaker Classic	yes/no	Cubical, plastic, w/ harvest doors (use 1/4 " wire mesh for floor)	$99.00	Sunset Garden Supply 320 Alemany Blvd. S.F., CA (415) 648-4242
Tumblebug	yes	Spherical, plastic tumbler, 2 sizes	$120–179	Environmental Applied Products 2029 N. 23rd St. Boise, ID 83702, (800) 531-0102
Worm-A-Way	yes	Recycled plastic, w/ aeration tubes	$76-99	Flowerfield Enterprises 10332 Shaver Rd. Kalamazoo, MI 49024, (616) 327-0108
WormFactory**	yes	Cubical stacking worm bin, 100% recycled plastic	**$19.50-69**	***San Francisco's '97-'98 Bargain Worm Bin, just $19.50 to S.F. residents! See below.*** Viscor Distrib. Inc. 12165 Cherrywood Dr. Maple Ridge, B.C., Canada V2X 0B7, (800) 609-1223

* Prices listed are subject to change.

** *The **EARTH MACHINE** and the **WORM FACTORY** are San Francisco's '97-'98 Bargain Compost Bins—**ONLY $19.50** to City residents, an **80% DISCOUNT!** For one-day-sale event dates and times call the Rotline: (415) 285-7585.*

Additonal Resources

Worms

Cole Hardware 956 Cole Street (415) 753-2653	Floorcraft 470 Bayshore Blvd., San Francisco (415) 824-1900	Rainbow Worm Farms (916) 758-9906, Davis, CA
Cole Hardware 3312 Mission Street (415) 647-8700	Goodman's Lumber 445 Bayshore Blvd., San Francisco (415) 285-2800	Sloat Garden Centers All locations (415)566-1800
Green World Mercantile 2340 Polk Street, San Francisco (415) 771-5717	Yahoo Herb & Ecology 968 Valencia, San Francisco (415) 282-9676	Sonoma Valley Worm Farm Mail Order (800) 447-6996

Sawdust	**Woodchips**
Try cabinet makers and/or lumber yards nearest you, but beware of chemically treated woods. Custom Woodwork 350 Treat Ave., San Francisco (415) 552-4656 $5 for large bag; call first Per Madsen 1081 revere St., San Francisco (415) 822-4883 free; call first California Wood Turning 1624 Kansas St., San Francisco (415) 642-9055 free; call first	Costello's Tree Service (415) 664-8733 Dave's Tree Service (415) 553-2553 Guastucci's Tree Service (415) 777-0378 "A" Tree Service (415) 755-5804 **Manure** Mar Vista Stables 2152 Skyline Blvd., Daly City (415) 991-4224 Call first

APPENDIX F

Curriculum and Activities

"I Can Compost" F-1

Basic Composting Worksheet F-2

Warming Up to Worms F-3

I Can Compost

Introductory Activity
Grades 2-6

Objective
Students will play a game that reinforces their knowledge of what materials can and cannot be composted.

Time
20-30 minutes

Materials Needed

One ball (soft and tossable)

Background Information

Anything that can decompose is biodegradable material. Biodegradable materials include wood chips, twigs, straw, paper, leaves, manure, fruits, and vegetables. Some less common materials are dryer lint, kelp, junk mail, and old cotton clothes. All of these materials can be composted at home.

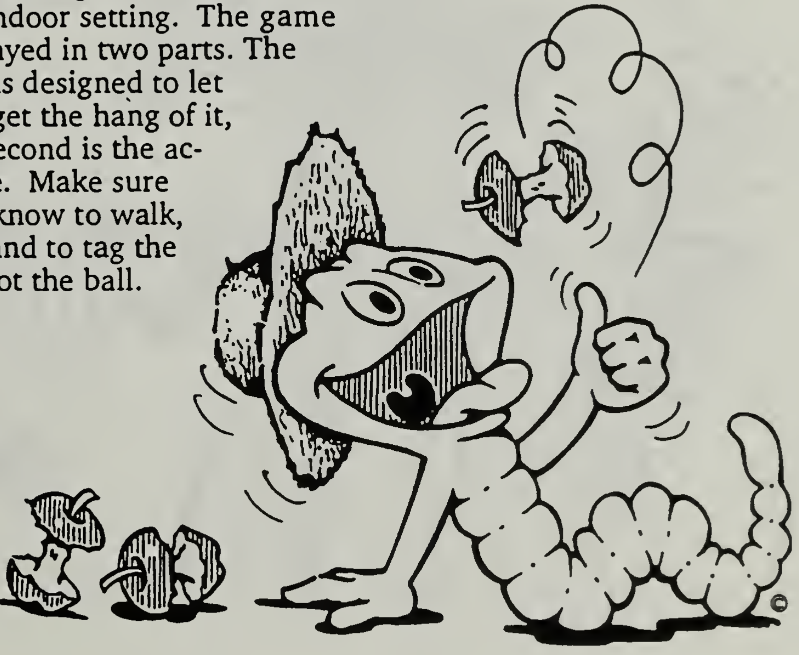
Management Skills

In order for students to enjoy the game, they need a thorough knowledge of what kinds of materials can be composted. The game is best played outdoors, but can be played sitting down in a confined or indoor setting. The game can be played in two parts. The first part is designed to let students get the hang of it, and the second is the actual game. Make sure students know to walk, not run, and to tag the person, not the ball.

Procedure

1. Remind participants that some of the things we throw away, like aluminum cans and plastic bottles, do not decay. They are called non-biodegradable because the material they were made from does not decay easily. Banana peels, leaves, wood, and paper are all examples of biodegradable matter. Biodegradable matter can decay, or break down, and eventually becomes compost. Composting is a way of recycling the organic materials that the participants otherwise might throw away.

2. On the board or on individual papers, give participants three minutes to list as many biodegradable items as possible that could be composted. You may also want to list materials that cannot be composted.



Reprinted with permission from Alameda County Waste Management Authority

3. To start the game everyone stands (or sits) in a circle. The first part of the game is to give students a taste of the game. It is not tag at first.

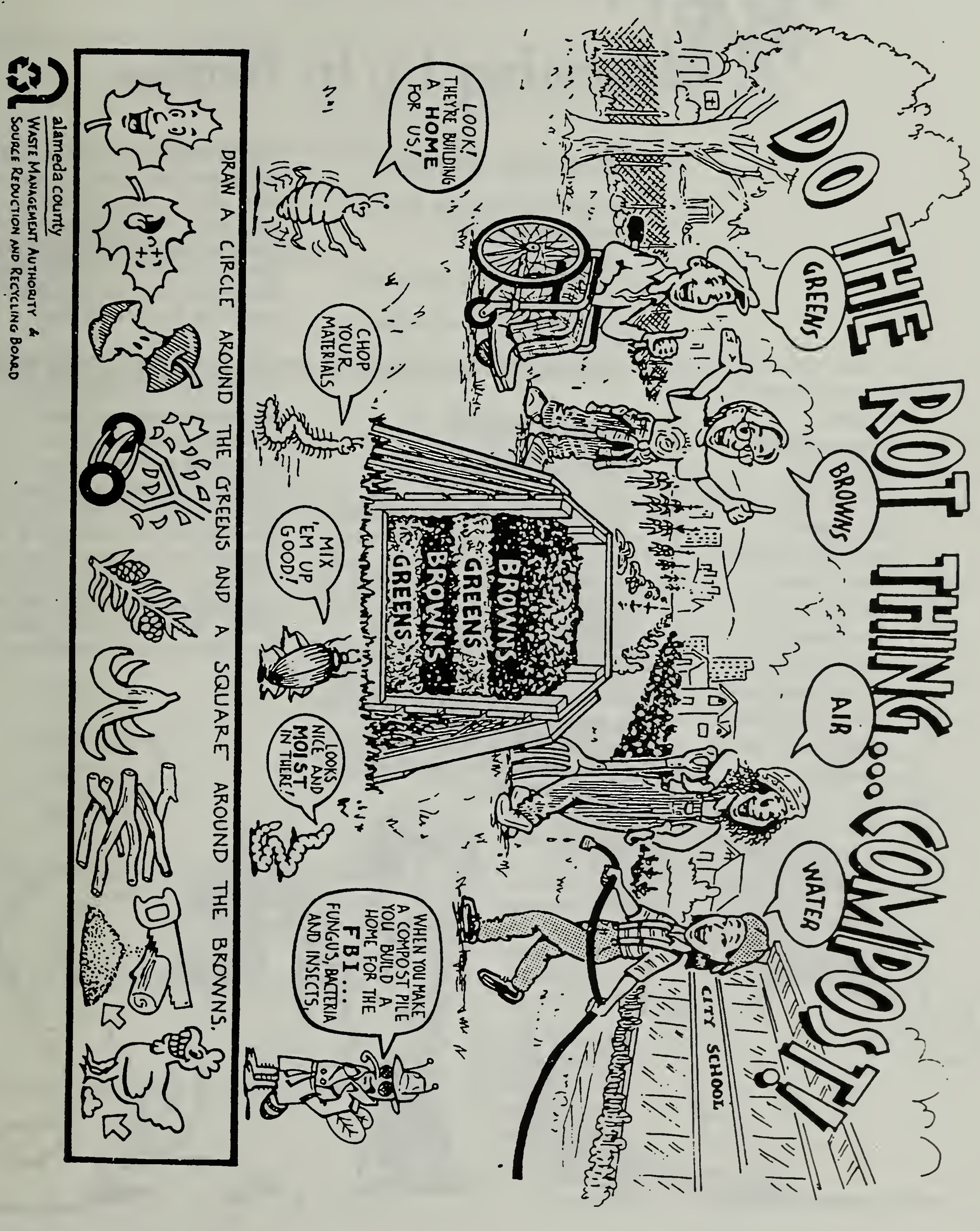
4. Call out a participant's name and something that can be composted: "Sarah, Banana Peel!" Toss the ball to the participant named and then sit down. The participants continue in this fashion, calling out compostable material and tossing the ball to the named participant, until everyone is sitting.

5. Now the tag part can begin. One participant is placed in the middle of the circle and becomes "it." The person in the middle must tag the person with the ball before the ball is tossed. The person throwing the ball names something that can be composted and then throws it to someone else before being tagged. If the student with the ball doesn't name something before s/he throws the ball, s/he will be tagged, become "it," and change places with the one in the middle.

Source: *Composting Across the Curriculum, Marin County Department. of Solid Waste*

Reprinted with permission from Alameda County Waste Management Authority

BASIC COMPOSTING WORKSHEET


DO THE ROT THING... COMPOST!
GREENS
BROWNS
AIR
WATER
LOOK! THEY'RE BUILDING A HOME FOR US!
CHOP YOUR MATERIALS
MIX 'EM UP GOOD!
LOOKS NICE AND MOIST IN THERE!
WHEN YOU MAKE A COMPOST PILE YOU BUILD A HOME FOR THE FBI... FUNGUS, BACTERIA AND INSECTS.
BROWNS
GREENS
BROWNS
GREENS
CITY SCHOOL

DRAW A CIRCLE AROUND THE GREENS AND A SQUARE AROUND THE BROWNS.

alameda county
Waste Management Authority &
Source Reduction and Recycling Board

Name: ______________________________ Date: ______________

Reprinted with permission from Alameda County Waste Management Authority

Warming Up to Worms

Worm Composting
Grades 3-6

Objective
Participants will:
- learn about worms and their role in nature through observation and discussion, and
- overcome fear of worms.

Time
20-40 minutes

Materials Needed

- Magnifying boxes or glasses (younger students)
- Worms
- *Warming Up to Worms* Worksheets (p. 33)
- Paper towel (older students only)
- Toothpicks (older students only)

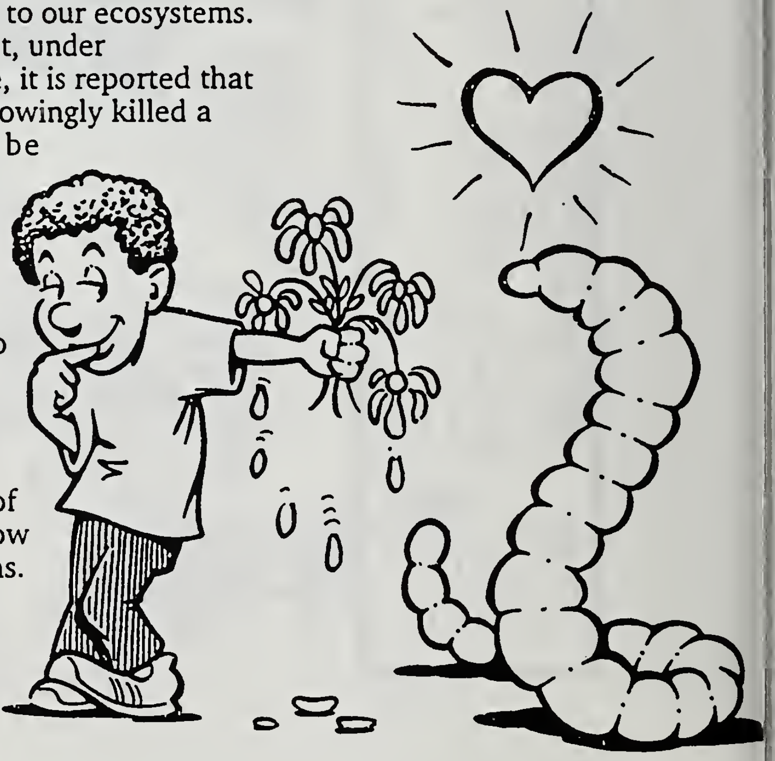
Background Information

Worms are incredible decomposers. The worms we use for composting in boxes are surface feeders called *eisenia foetida*. They are also called manure worms, red wigglers, or redworms. Over 7,000 species of worms inhabit the world, and they have always been important to our ecosystems. In ancient Egypt, under Cleopatra's rule, it is reported that anyone who knowingly killed a worm would be sentenced to death. Today, there are engineers in India who are learning how to clean sewage water using worm systems.

There are lots of fun facts to know about redworms. They have five pairs of hearts, no eyes, and no teeth. They breathe through their skin, and need dark, moist surroundings. Eight adult redworms can produce 1,500 offspring within si months, if conditions are favorable. Each worm is both male an female and can eat over half of its weight in food every day.

Management Skills

Worms are very sensitive to light, so handle them with care. Make sure there is a moist piece of paper towel in each participant's magnifying box. You should also put a little bit of bedding or worm castings in the magnifying box with them. For older students, use moist paper towels and toothpicks. Younger children may not be able to use the worksheet.



Reprinted with permission from Alameda County Waste Management Authority

WARMING UP TO WORMS

1) What color is the worm?

2) What shape is the worm? Describe it.

3) How does the worm's skin feel?

4) Is there a difference between the top side and bottom side of a worm? Describe what both sides are like.

5) Can you tell which is the front end of a worm and which is its tail? How do you know?

6) Does an earthworm have ....

EYES?

EARS?

LEGS?

A NOSE?

A MOUTH?

7) How does your worm move? Describe it.

8) What's the name of your worm?

9) Why are worms important to life on earth?

Name:______________________________ Date:____________

Reprinted with permission from Alameda County Waste Management Authority